

Northumbria Research Link

Citation: Mahdiputra, Suyanto (2007) Organisational learning in UK construction companies. Doctoral thesis, Northumbria University.

This version was downloaded from Northumbria Research Link:
<https://nrl.northumbria.ac.uk/id/eprint/293/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>



**Northumbria
University**
NEWCASTLE



UniversityLibrary

Northumbria Research Link

Citation: Mahdiputra, Suyanto (2007) Organisational learning in UK construction companies. Doctoral thesis, Northumbria University.

This version was downloaded from Northumbria Research Link:
<http://nrl.northumbria.ac.uk/id/eprint/293/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>



**Northumbria
University**
NEWCASTLE



UniversityLibrary

ORGANISATIONAL LEARNING IN UK CONSTRUCTION COMPANIES

SUYANTO MAHDIPUTRA

PhD

2007

ORGANISATIONAL LEARNING IN UK CONSTRUCTION COMPANIES

SUYANTO MAHDIPUTRA

A thesis submitted in partial fulfilment
of the requirements of the
University of Northumbria at Newcastle
for the degree of
Doctor of Philosophy

Research undertaken in the School of the Built Environment

December 2007

Abstract

This thesis advances the proposition that all organisations learn and that learning profiles vary across organisations of different types. However, successful organisations are those that have developed their organisational learning systems in accordance with their competitive strategies. It is the central objective of this thesis to test this proposition in UK construction companies that engage with the *North East Constructing Excellence* initiative.

The research was organised through stages involving a *business environment audit* survey to establish the context of the sample population and a *learning competence test* for sample validation. Through a series of investigations using structured interviews into 12 selected companies that represented the higher and the lower learning companies, data was obtained that allowed the practices of various learning mechanisms to be examined, analysed, compared, pattern-matched and modelled.

The findings revealed a pattern of commonality in learning profiles of construction companies, which can be represented in terms of a two-category typology, namely the *externally-focused* and the *internally-focused learning companies*. More successful companies tend to retain one learning mode, related to their competitive strategy and choice of economic model. These successful companies also direct themselves to one or two portfolios of sharing/retention mechanisms to suit their specific needs related to size and geographical spread, as well as their category of contracting activity. One significant outcome is that companies adopting a balanced learning strategy, that includes both internal and external learning sources, tend towards longevity although they may not be the most profitable. Companies that favour internal learning generally specialise in a particular aspect of construction, can be very profitable, but are susceptible to any change in the market. It may be that the managers recognise this situation and have a strategy for a series of highly profitable short-term companies. Overall, these results reflect the contribution of this thesis to the existing knowledge.

In addition, the study also contributes in establishing a framework for mapping the practice of organisational learning that can illustrate to management where their learning efforts have been focused. A further discovery was that over 60% of the sample companies did not realise that they are operating a particular learning strategy. Using this framework, other UK construction companies can enter their own data onto the model to discover where they are positioned. This will be useful information for companies developing and/or reviewing their business strategies.

List of Contents

1. INTRODUCTION.....	1
1.1 Background	2
1.2 Justification of the Research	4
1.3 Research Goals.....	8
1.3.1 Purpose	8
1.3.2 Proposition.....	8
1.3.3 Objectives	9
1.4 Scope of Research	9
1.5 Justification of Research Methodology.....	11
1.5.1 Research Design	13
1.5.2 Theoretical Perspectives.....	14
1.5.3 First Stage Data Collection and Sample Validation	16
1.5.4 Full Data Collection and Model Development	19
1.5.5 Discussion and Conclusions	23
1.6 Chapter Conclusions	23
2. THEORETICAL PERSPECTIVES.....	24
2.1 Organisational Learning: An Overview	27
2.1.1 Organisational Learning Research: Descriptive versus Normative	28
2.1.2 Definitions of Organisational Learning and a Learning Organisation.....	29
2.1.3 Multilevel Learning	33
2.1.4 Habits of Inquiry	34
2.1.5 Shared Understandings.....	34
2.1.6 Behavioural/Cognitive Change	35
2.1.7 The Link between Individual and Organisational Learning	36
2.2 Types and Levels of Learning.....	39
2.2.1 Argyris and Schön's Classification of Learning	40
2.2.2 Fiol and Lyles's Classification of Learning.....	43
2.2.3 Garratt's Classification of Learning	44
2.2.4 Learning Orientations	46
2.2.5 Knowledge Acquisition: Internal vs. External	47
2.2.6 Knowledge Sharing: Formal vs. Informal	48
2.2.7 Knowledge Retention: Personalisation vs. Codification	49
2.3 Characteristics of Learning Organisations	51
2.3.1 People-focused Approach.....	51
2.3.2 Strategic-focused Approach.....	51
2.3.3 Tool or Technology-focused.....	52
2.3.4 Context Development-focused.....	53
2.3.5 Systemic or Holistic Approach	54
2.3.6 An Attempt at Synthesis.....	56

2.4	Organisational Learning and Knowledge.....	58
2.4.1	Understanding Knowledge: Tacit versus Explicit	58
2.4.2	Knowledge Creation Model.....	60
2.4.3	Corporate Memory.....	62
2.5	Organisational Learning Systems	65
2.5.1	Organisational Learning as a Process	66
2.5.2	Organisational Learning Mechanisms.....	67
2.5.3	Enabling Conditions	67
2.6	Organisational Learning Process	70
2.6.1	March and Olsen's Model	70
2.6.2	Dixon's Model	71
2.6.3	Huber's Model	71
2.6.4	Nevis <i>et al.</i> 's Model.....	72
2.7	Organisational Learning Mechanisms	73
2.7.1	Mechanisms for Learning from Internal Sources	74
2.7.2	Mechanisms for Learning from External Sources	84
2.7.3	Informal Knowledge Sharing Mechanisms	88
2.7.4	Formal Knowledge Sharing Mechanisms.....	98
2.8	Enabling Conditions for Organisational Learning.....	111
2.8.1	Enabler 1: Provide Incentive for Learning	113
2.8.2	Enabler 2: Value Creative Errors	114
2.8.3	Enabler 3: Provide a Climate of Openness	115
2.8.4	Enabler 4: Promote Freedom of Speech.....	116
2.8.5	Enabler 5: Foster Inquiry and Dialogue	117
2.8.6	Enabler 6: Foster a Spirit of Innovation and Experimentation.....	118
2.8.7	Enabler 7: Embrace Constructive Change.....	119
2.8.8	Enabler 8: Build a Democracy at Work	119
2.8.9	Enabler 9: Develop an Easy Access to Information	121
2.8.10	Enabler 10: Support Personal Development	122
2.8.11	Enabler 11: Facilitate Informal Learning	122
2.8.12	Enabler 12: Promote Inter-personal and Team Interactions	123
2.8.13	Enabler 13: Delegate Autonomy to Project Teams	124
2.9	The Limits of Organisational Learning.....	125
2.9.1	Organisational Learning and Performance	125
2.9.2	Competency Traps.....	125
2.9.3	The Difficulties of Organisational Learning.....	126
2.10	Chapter Conclusions	127

3. CONCEPTUAL FRAMEWORK AND HYPOTHESES	128
3.1 Organisational Learning System and Its Elements	129
3.1.1 Knowledge Acquisition.....	130
3.1.2 Knowledge Sharing	132
3.1.3 Knowledge Retention.....	134
3.1.4 Measuring Organisational Learning Competence	137
3.2 A Framework for Investigating Learning in Construction Organisations	142
3.2.1 Conceptual Model.....	142
3.2.2 Development of Hypotheses	143
3.2.3 Summary of Hypotheses	146
3.3 Chapter Conclusions	147
4. FIRST STAGE DATA COLLECTION AND SAMPLE VALIDATION.....	148
4.1 The Business Environment Audit	148
4.1.1 The Audit Process.....	149
4.1.2 Results.....	151
4.1.3 Summary: A Snapshot of the NE Construction Activities	159
4.2 The Learning Competence Test	161
4.2.1 The Assessment Process.....	161
4.2.2 Results.....	164
4.2.3 Summary and Observations.....	168
4.2.4 Selecting Case Companies.....	168
4.2.5 Gap Analysis on Company Learning.....	174
4.3 Chapter Conclusions	176
5. FULL DATA COLLECTION AND MODEL DEVELOPMENT.....	177
5.1 Overview of Methodology	177
5.1.1 Sample Selection	178
5.1.2 Data Collection.....	179
5.1.3 Data Analysis	179
5.2 Results.....	180
5.2.1 Results of External Knowledge Acquisition Mechanisms	180
5.2.2 Results of Internal Knowledge Acquisition Mechanisms	183
5.2.3 Results of Informal Knowledge Sharing Mechanisms.....	186
5.2.4 Results of Formal Knowledge Sharing Mechanisms.....	190
5.2.5 Results of Personalisation Mechanisms	195
5.2.6 Results of Codification Mechanisms	199
5.2.7 Differences in Responses by Respondents' Position	203
5.2.8 Cross Case Comparison on the Use of Learning Mechanisms	206
5.3 Model Development.....	212
5.3.1 Modelling the Practice of Knowledge Acquisition.....	213
5.3.2 Modelling the Practice of Knowledge Sharing	214
5.3.3 Modelling the Practice of Knowledge Retention	215

5.4	Learning Profiles of UK Construction Companies	220
5.4.1	Pattern-Matching Analysis: Internal versus External Learning	221
5.4.2	Pattern-Matching Analysis: Formal versus Informal Knowledge Sharing..	223
5.4.3	Pattern-Matching Analysis: Personalisation versus Codification	225
5.4.4	Selected Best Cases: Toward a Best Practice Model	226
5.5	Model Evaluation	234
5.5.1	Results of Empirical Evaluation	235
5.6	Chapter Conclusions	239
6.	DISCUSSION, CONCLUSIONS AND CONTRIBUTION TO KNOWLEDGE.....	240
6.1	Discussion of Main Findings and Hypotheses Testing	240
6.1.1	Knowledge Acquisition.....	241
6.1.2	Knowledge Sharing	244
6.1.3	Knowledge Retention.....	246
6.2	Empirical Validation of Research Propositions	247
6.3	Contribution to Knowledge.....	251
6.4	Implication for Practice.....	254
6.5	Reflections on the Research Approach	254
6.6	Recommendations for Future Research	255
6.7	Chapter Conclusions: Final Reflections.....	256
	APPENDICES	257
	Appendix 1: The Business Environment Audit Questionnaire	258
	Appendix 2: The Learning Competence Test Questionnaire	259
	Appendix 3: Full Data Collection Protocol.....	262
	Appendix 4: Follow-up Questionnaire on Learning Profiles	268
	REFERENCES.....	269
	Books.....	270
	Journals	278
	Research Reports.....	297
	Conference Papers.....	298
	Unpublished Work	299
	Recommended Further Reading.....	299
	PUBLICATIONS RESULTING FROM THE RESEARCH.....	300

List of Tables

Table 1.1	Number of research participants by position.....	21
Table 2.1	Organisational learning definition as provided by different authors.....	30
Table 2.1	(Continued).....	31
Table 2.2	Definition of a learning organisation as provided by different authors.....	32
Table 2.3	Content analysis to delineate some commonalities on the concept of organisational learning.....	36
Table 2.4	Learning Types and Levels.....	40
Table 2.5	Characteristics of single, double and triple loop learning (Argyris and Schön, 1978)	42
Table 2.6	Different characteristics of lower and higher level learning (Fiol and Lyles, 1985)	43
Table 2.7	Seven different Learning Orientations.....	46
Table 2.8	Basic assumptions in personalisation versus codification	50
Table 2.9	The characteristics of tacit and explicit knowledge	59
Table 2.10	Definitions of corporate memory and its means of retention.....	63
Table 2.11	Retention media and memory contents.....	64
Table 2.12	Framework for enabling learning from failures.....	81
Table 2.13	Reframing the traditional managerial mindset for learning	82
Table 2.14	Nature of ties in personal learning networks	91
Table 2.15	Description of different note-taking methods	95
Table 2.16	Differences between teams and communities of practice	99
Table 2.17	A summary of Intranet technology use modes.....	104
Table 2.18	Type of errors (adapted from Kriegesmann <i>et al.</i> , 2007).....	115
Table 2.19	Types of learning in deliberative policy making processes	120
Table 3.1	Summary of hypotheses.....	146
Table 4.1	Statements representing the ideal qualities of a learning company	162
Table 4.2	An example of questionnaire statement and its description.....	162
Table 4.3	Characteristics of companies in the study sample	163
Table 4.4	Nonparametric Correlations.....	165
Table 4.5	Spearman's Rank correlation between two variables and company growth.....	166
Table 4.6	Spearman's Rank correlation between selected learning competence criteria and company size	167

Table 4.7	Rank of companies according to their learning competence scores	169
Table 4.8	Multicriteria matrix for companies in the 10 th rank	170
Table 4.9	Matrix of concordance subsystems (J^c)	171
Table 4.10	Concordance matrix	172
Table 4.11	Outcomes of concordance test	172
Table 4.12	General attributes of the high learning companies.....	173
Table 4.13	General attributes of the low learning companies.....	173
Table 5.1	Composition of participants in the primary study phase.....	178
Table 5.2	The extent of the use of project teams as learning sensors	180
Table 5.3	The extent of the use of marketing division to learn the markets	181
Table 5.4	The extent of the use of special expertise to scan outside world	182
Table 5.5	The extent of the use of benchmarking to learn from competitors	182
Table 5.6	The extent of the use of quality circles as part of internal organisational learning activities.....	183
Table 5.7	The extent of the use of project reviews to support organisational learning	184
Table 5.8	The extent of the use of lessons learned from project failures to improve subsequent projects.....	185
Table 5.9	The extent of the use of lessons learned from project successes to improve the overall organisational performance	185
Table 5.10	Frequencies of using social activities and informal gatherings for sharing knowledge.....	186
Table 5.11	Frequencies of using personal networking for the exchange of knowledge or experiences.....	187
Table 5.12	Frequencies of using informal storytelling sessions to share learning.....	188
Table 5.13	Frequencies of information exchange between project team members	188
Table 5.14	Frequencies of using personal notes to share knowledge with colleagues	189
Table 5.15	Frequencies of using voluntary case writings to share experiences.....	190
Table 5.16	Frequencies of using formalised communities of practices to share information or exchange experiences.....	191
Table 5.17	Frequencies of using inter-project visit schemes to learn or share experiences.....	191
Table 5.18	Frequencies of using intranets to search, send, store, and exchange information	192
Table 5.19	Frequencies of using company newsletters to update knowledge or spread information	193
Table 5.20	Frequencies of using lessons learned databases to source knowledge.....	194

Table 5.21	Frequencies of using standardisation of methods and best practices	195
Table 5.22	Frequencies of using stories for knowledge retention	196
Table 5.23	Frequencies of using personal networks for knowledge retention.....	196
Table 5.24	Frequencies of using social meetings and informal gatherings for knowledge retention	197
Table 5.25	Frequencies of using communities of practice for knowledge retention	197
Table 5.26	Frequencies of utilising project sites as knowledge context	198
Table 5.27	Frequencies of using intranets for knowledge retention	199
Table 5.28	Frequencies of producing codified information.....	199
Table 5.29	Frequencies of producing personal notes to record facts, decisions and actions ...	200
Table 5.30	Frequencies of using personal case writings to record personal experiences	201
Table 5.31	Frequencies of using standardised methods and best practices for knowledge retention	201
Table 5.32	Frequencies of using company databases to store information.....	202
Table 5.33	Frequencies of using company newsletters as a knowledge retention mechanism	202
Table 5.34	Differences in responses by respondents from high learning companies	203
Table 5.35	Differences in responses by respondents from low learning companies	203
Table 5.36	Summary Sheets for Companies A, B, and C	216
Table 5.37	Summary Sheets for Companies D, E, and F.....	217
Table 5.38	Summary sheets for Companies G, H, and I.....	218
Table 5.39	Summary Sheets for Companies J, K, and L	219
Table 5.40	Pattern-matching analysis for internal and external learning.....	221
Table 5.41	Pattern-matching analysis for formal and informal knowledge sharing	223
Table 5.42	Pattern-matching analysis for personalisation and codification.....	225
Table 5.43	Best practice models for managing internal and external learning	227
Table 5.44	Characteristics of internally- and externally-focused learning organisations	229
Table 5.45	Best practice models for managing knowledge sharing and retention.....	231
Table 5.46	Summary of responses from the follow-up model evaluation	237
Table 5.46 (Continued)	238
Table 6.1	Typology of construction companies learning: How UK construction companies manage their learning	248
Table 6.2	Knowledge sharing portfolio: A framework for managing knowledge sharing/retention in construction companies	250

List of Figures

Figure 1.1	An increasing number of construction companies in the UK	2
Figure 1.2	Percent of the UK Construction Industry's Contribution to GDP Between 1975 and 2005	4
Figure 1.3	The overall gross output of the UK construction industry	10
Figure 1.4	Research design (Modified and developed from Yin, 1994)	14
Figure 1.5	Illustration of screening process for sample validation.....	16
Figure 1.6	Origins of the sampling companies.....	20
Figure 1.7	The three-layer data collection approach	20
Figure 2.1	Number of academic publications in the Business Source Premier [EBSCO] database containing keywords "organisational learning" (searchable through Northumbria University's NORA system).....	25
Figure 2.2	Parent themes that make up this chapter	26
Figure 2.3	Multilevel learning as presented by Crossan <i>et al.</i> (1999)	33
Figure 2.4	The Kolb's (1984) learning cycle	37
Figure 2.5	Single-, double- and triple-loop learning (Probst and Buchel, 1997)	41
Figure 2.6	Garratt's (2000) model of organisational learning.....	44
Figure 2.7	Nonaka and Takeuchi's (1995) model of knowledge creation.....	60
Figure 2.8	The structure of corporate memory	64
Figure 2.9	Elements of organisational learning system.....	66
Figure 2.10	March and Olsen's (1975) model of organisational learning cycle	70
Figure 2.11	Organisational learning cycles as proposed by Dixon (1999).....	71
Figure 2.12	Interpretation of Huber's (1991) organisational learning process model.....	72
Figure 2.13	Nevis <i>et al.</i> 's (1995) organisational learning process model	73
Figure 2.14	The PDCA cycle after Shewhart and Deming (1986) used in the quality circle process.....	75
Figure 2.15	The Reading model of benchmarking for construction.....	86
Figure 2.16	Callahan's (2006) 'arrow and cloud'	100
Figure 2.17	Process-step development of lessons learned artefacts	107
Figure 2.18	The incomplete learning cycles (Adapted from March and Olsen, 1975)	126
Figure 3.1	Organisational learning requirements	128
Figure 3.2	Organisational learning as a continuous and interactive process	129
Figure 3.3	Knowledge acquisition model	131
Figure 3.4	Knowledge sharing model.....	134
Figure 3.5	Knowledge retention model.....	136

Figure 3.6	Measuring the extent of organisational learning competence	138
Figure 3.7	Elements of an organisational learning system	142
Figure 4.1	The distribution of UK construction companies by number of employees (DTI, 2006)	148
Figure 4.2	Geographical context of the present study.....	151
Figure 4.3	Geographical coverage of works by sample companies.....	152
Figure 4.4	Categories of construction activity by sample companies.....	152
Figure 4.5	Composition of construction works by sample companies	153
Figure 4.6	Type of work carried out by sample companies	154
Figure 4.7	Construction classification by sample companies	154
Figure 4.8	Size of projects engaged by sample companies.....	155
Figure 4.9	Largest projects handled by sample companies.....	155
Figure 4.10	Procurement system engaged by sample companies	156
Figure 4.11	Number of direct employees by responding companies.....	157
Figure 4.12	Number of direct employees by 30 sample companies	157
Figure 4.13	Number of direct staff employed by sample companies.....	158
Figure 4.14	Project team organisation by sample companies	158
Figure 4.15	Learning gaps for the high performer group.....	175
Figure 4.16	Learning gaps for the low performer group.....	175
Figure 5.1	Charts showing the variations of means provided by managers in the high learning companies	204
Figure 5.2	Charts showing the variations of means provided by managers in the low learning companies.....	205
Figure 5.3	External knowledge acquisition mechanisms by companies	206
Figure 5.4	Internal knowledge acquisition mechanisms by companies	207
Figure 5.5	Informal knowledge sharing mechanisms by companies	208
Figure 5.6	Formal knowledge sharing mechanisms by companies.....	209
Figure 5.7	Personalisation mechanisms by companies	210
Figure 5.8	Knowledge codification mechanisms by companies.....	211
Figure 5.9	Radar diagram of knowledge acquisition	213
Figure 5.10	Radar diagram of knowledge sharing	214
Figure 5.11	Radar diagram of knowledge retention.....	215
Figure 5.12	Template for company resumes.....	220
Figure 5.13	Results of follow-up evaluation.....	235

Acknowledgements

*This research was supported and fully funded by
Northumbria University Postgraduate Research Studentship*

This thesis is the tangible outcome of an intense intellectual journey that has carried me through different literatures, organisations, people, and learning experiences. Throughout this long journey, I was comforted and supported by a number of academics, mentors and friends.

First and foremost, I am deeply indebted to my supervision team, Professor Bob Giddings, Keith Hogg and Michael Daws. Their invaluable guidance, constant encouragement, endless support and insightful advice have been crucial, both in personal and professional terms. I am particularly grateful for the genuine concern they have shown not only for the completion of this study, but also for the achievement of a certain standard of good academic work.

The School of the Built Environment provided an ideal work environment and the facilities required to carry out the research. I fully acknowledge the help from respondents who made this study possible and thank them for their participation in the research. I am particularly thankful to Catriona Lingwood of the *North East Constructing Excellence* office for her help in identifying the potential companies invited to participate in this research and in sending them the questionnaire.

I wish to thank my grandparents and parents who always inspired me and supported me in my attempts to obtain the highest possible level of education. My last word of gratitude goes to someone in my heart, for having supported this endeavour with some thought-provoking ideas and creativity.

Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work.

Name: Suyanto Mahdiputra

Signature:

Date: December 2007

1. Introduction

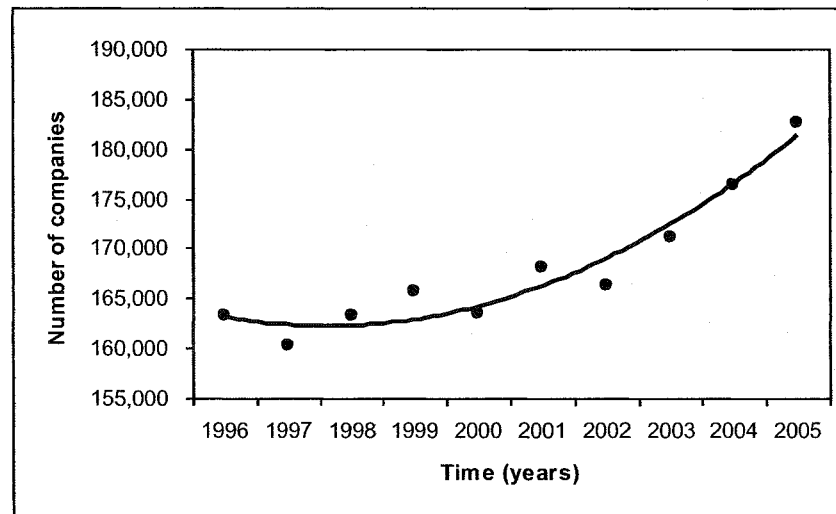
*There is no difference in the destination;
the only difference is in the journey.*

-Inayat Khan (1882-1927)

This research journey explores the nature and extent of organisational learning in construction companies. Construction is a project-based industry and is often regarded as unique in that no two construction outputs, such as buildings or bridges, are exactly the same; they may have different locations or be built to different specifications. Even ‘identical’ buildings, such as the ‘Petronas Twin Towers’ in Kuala Lumpur, still have different technical problems arising during construction (Kazi, 2005: vi). Unlike manufacturing industries, the opportunity to improve the *next-model year* does not exist. The benefits of ‘learning-curve effect’ inherent in mass production are also difficult to achieve in construction (Couto and Teixeira, 2005). Given the proposition that the success of a construction business is dependent on its ability to integrate learning into its business processes (Cavaleri and Fearon, 2006), it is not surprising that maintaining an appropriate balance of engagement in various learning mechanisms is a challenge to the most competent learning company (Hodgkinson and Sparrow, 2002).

The construction business environment is very competitive. As Williamson *et al.* (2004: 61) note, the industry “consists of a set of markets that form a very competitive system, so competitive that it has been said to be one of the closest systems to perfect competition”. As a result, the construction sector has one of the lowest profit margins (Egan, 1998; Akintoye and Skitmore, 1991; Cheah *et al.*, 2007). The rate of insolvencies of construction companies is also quite high (Langford *et al.*, 1993; Edum-Fotwe *et al.*, 1996). Nevertheless, construction remains attractive to many business players, drawing more and more entrepreneurs to the industry, as *Figure 1.1* indicates. In short, construction is a vibrant industry with many challenges.

Figure 1.1
An increasing number of construction companies in the UK
(Data source: DTL, 2006)



1.1 Background

The challenges facing construction companies worldwide are well documented (Schaafsma, 1997; Shirong, 2001; Ngowi, 2002; Husin and Rafi, 2003; Karvinen and Bennett, 2006). A mixture of increasing market forces, product changes, client demand, user concern and legislative pressure requires construction companies to be more vigilant and forward-looking in order to survive, let alone to do well. DeGeus (1996) considers the ability to learn faster than competitors may be the only source of sustainable competitive advantage. Paradoxically, within the construction sector, learning does not seem to be widely achieved. Critics constantly remind the industry of cost and schedule overruns experienced by construction projects all over the world (ILO, 2001; Bon and Crosthwaite, 2000).

Within the UK construction industry for instance, concern about the performance of the industry in terms of ability to deliver projects on budget, on time and to a satisfactory quality has repeatedly been expressed by many scholars and practitioners (Latham, 1994; Egan, 1998; and Flanagan *et al.*, 1998). A recent commentator to express this concern is Chris Fortune (2006), who states “the UK construction industry has a reputation for delivering its projects over budget”. He cites the new Wembley sports stadium and the new Scottish Parliament building projects, both reported as severely

over budget, as the latest high-profile examples that support his statement. Historically, the same phenomenon was evidenced more than 180 years ago when George Stephenson built a railway from Liverpool to Manchester in the 1820s, which cost 45% more than the original budget and was subject to several delays in completion (*Economist*, 2005). Striking figures reported in NAO (2001) are that 70% of departments' and agencies' construction projects were delivered late, whilst 73% were over budget.

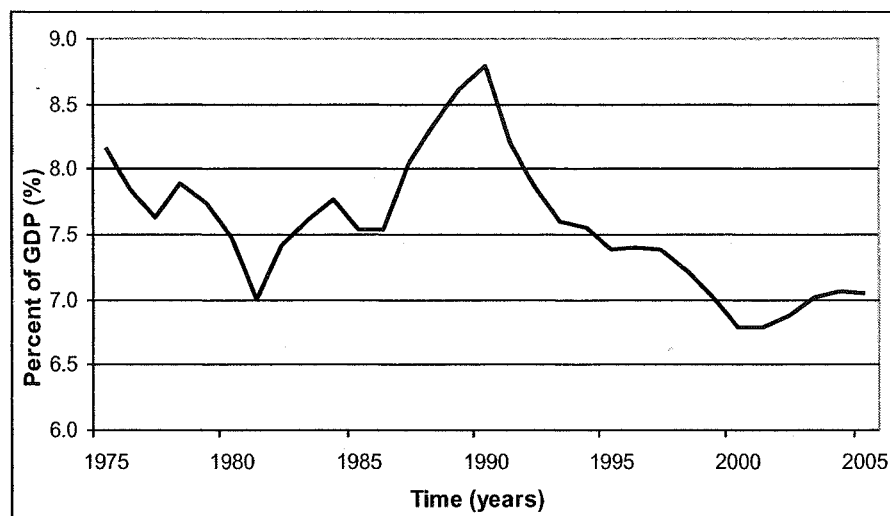
Many reasons contribute to the poor performance of construction companies on their projects. One major issue, as reported in Egan (1998), is the lack of a culture of learning from previous projects or the construction industry's best practice: "upgrading, retraining and continuous learning are not part of construction's current vocabulary". The National Audit Office summarises issues that need to be urgently addressed for better construction performance, including the development of a learning culture on projects and within organisations (NAO, 2001). If learning is to be promoted within the construction industry, it may be useful to gain knowledge of successful learning practices from other industries. This can be achieved through a study of generic organisational learning, primarily developed in routine-based organisations, which can be integrated into project-based construction organisations. This view is shared by the Task Force led by Sir John Egan who believes the construction industry can learn from the successes of manufacturing and service industries and urges the industry "to learn as much as possible from those who have done it elsewhere" (Egan, 1998).

The need for learning in construction is strongly emphasised in the Latham (1994) and Egan (1998) reports. The reports call for improvements in the construction delivery process to improve efficiency and productivity, and thus ensure value for money for the industry's clients. More specifically, the Egan report stresses the urgency of '*sustaining improvement* and *sharing learning*'. In replying to this call, research is needed to help construction companies better understand the value of learning about their effectiveness, identifying their strengths and improving their learning practices. Construction companies would then be better equipped to assess the impact of different learning practices on their effectiveness. The companies could thereby be driven by learning orientation and the industry's image of learning culture may be improved.

1.2 Justification of the Research

The UK construction industry is a major contributor to the nation's gross domestic product [GDP]. Depending on the strength of the economy in any given year, the construction industry comprises around 8% of the GDP. *Figure 1.2* shows the fluctuation in the construction industry's contribution to GDP over a 30 year time span. However, according to the National Audit Office report (NAO, 2001) and numerous papers written on the subject, the UK allocates less than 0.5% of gross national sales in construction for research and development. By contrast, in Japan the top five construction companies invested 1% of their turnover in research and development. Moreover, as noted in NAO (2001), the majority of industry research is commissioned by suppliers of construction materials, components and systems. Consequently, there is very little research that addresses the needs of the construction industry, especially in the areas of learning and management.

Figure 1.2
Percent of the UK Construction Industry's Contribution to GDP
Between 1975 and 2005



(Data source: National Statistics)

However, since the publication of the Latham and Egan reports, there have been some noticeable improvements in the construction industry. A number of initiatives, such as the *CONSTRUCTION BEST PRACTICE PROGRAMME* and the *MOVEMENT FOR INNOVATION*, which later merged to become *CONSTRUCTING EXCELLENCE*, have

helped to promote the culture of learning and sharing, for example through the adoption of benchmarking, performance measurement, partnering, sharing best practice, demonstration projects, continuous improvement and knowledge management; all of which are now more prevalent within UK construction companies (Cain, 2003; Delgado-Hernandez and Aspinwall, 2005; Robinson *et al.*, 2005). In parallel with this, there is a growing body of academic research examining different themes of learning in relation to construction. Research by Boyd and Robson (1996), using action research, examined the enhancement of learning in two construction projects. Barlow and Jashapara (1998) analysed organisational learning in the context of project partnering. Using the example of a high value and high complexity offshore oilfield construction project, Barlow (2000) examined the use of partnering as a mechanism for stimulating learning. Franco *et al.* (2004) developed a framework for generating lessons learned from a construction project through a review workshop mechanism, called the *Cross Organisational Learning Approach* [COLA].

Similar studies from other European countries also appear in the literature. Thuesen (2005) undertook an ethnographic study of a construction project in Denmark. This study uses the Actor Network Theory and theories of Communities of Practice to develop an analytical strategy for understanding the 'life' of learning in projects. Styhre *et al.* (2004) studied organisational learning in six Swedish construction projects, where they found construction projects primarily rely on informal and personal contacts rather than more formal reporting and computer-based management control systems.

Despite a number of contributions by earlier researchers that address learning in UK construction, most analyses have been focused on learning at project level (Boyd and Robson, 1996; Barlow and Jashapara, 1998; Barlow, 2000; Franco *et al.*, 2004). There are, however, exceptions that analyse organisational learning in construction at the company level such as Kuluanga and others. Kuluanga *et al.* (2002) used a survey methodology investigating factors that promote double-loop learning as a strategy for improving business processes. Their study suggests the majority of construction companies concentrate their learning on continuous learning by individual employees.

Maqsood *et al.* (2006) conducted an interpretative investigation of the issues surrounding project histories for one leading construction company in Australia. In their study, they developed a framework for improving the learning from projects through the

development and use of project histories. However, the authors themselves acknowledged that the study was only relevant to a single organisation and was not devised to develop a correct general system that would be applicable for other organisations.

Moreover, as Vakola and Rezgui (2000) note, “despite the interest and the effort put by many leading construction companies into managing corporate knowledge bases leading to a corporate memory culture supportive of organisational learning, these efforts were seldom revealed most of the time and did not bring the expected improvements in business processes”. The authors acknowledge some limitations of current approaches to learning involving UK construction companies that include the following:

- (1) Much construction knowledge, of necessity, resides in the minds of the individuals working within the construction domain.
- (2) The intent behind decisions is often not recorded or documented. It requires complex processes to track and record the thousands of *ad hoc* messages, phone calls, memos, and conversations that comprise much project-related information.
- (3) People responsible for collecting and archiving project data may not necessarily understand the specific needs of the actors who will use it, such as those actors involved in the maintenance of the building(s).
- (4) The data are usually not managed whilst being created but instead are captured and archived at the end of the construction stage. People who have knowledge about the project are likely to have left for another project by this time and their input is not captured.
- (5) Lessons learned are not organised well and are buried in details, which makes it difficult to compile and disseminate useful knowledge to other projects.
- (6) Many companies maintain historical reports of their projects. Since people are constantly on the move from one company to another, it is difficult to reach the original report authors who understand the hidden meaning of historical project data. These historical data should include a rich representation of data context, so that they can be used with minimum (or no) consultation (Vakola and Rezgui, 2000: 175 –176).

The present study is an attempt to extend the existing research on organisational learning in UK construction companies. Sitting at the company level, it analyses how construction companies manage their internal and external learning and maps the companies' practices for sharing and storing learning. "Ability to learn from both the internal and external environments gives construction organisations a constant state of readiness for change and sustains continuous improvement" (Nesan, 2004).

Learning is being recognised as a vital source of competitive advantage in today's dynamic and changing business environment (Stata, 1996). Effective organisational learning is vital for any organisation to remain in the market. Organisational learning processes that involve knowledge development, sharing and exploitation is now generally accepted as vital for efficient working in projects and for improving organisational competitiveness.

This is particularly true for the construction industry. Effective learning systems in the construction companies are likely to produce innovation, improve productivity, improve quality and reduce project time (Love *et al.*, 2004). Groak (1994) argues that integrated learning becomes even more important for construction companies because the use of 'lessons learned' coming from projects affects the quality of the final product. Failure to capture and share project knowledge leads to an increased risk of repeating the same mistakes or reinvesting multi-efforts for the same solutions, wasted activity, and impaired project performance. Indeed, "organisational learning allows a construction company to identify the profitable markets, to forge partnering alliances with suppliers and subcontractors, to take advantage of technological innovations, and to establish good relationships with financial institutions, surety companies and potential owners" (Arditi *et al.*, 2000: 126).

In order to test this proposition and to examine how construction companies utilise the various learning mechanisms and how this relates to their effectiveness, a research study was carried out including interviews with corporate members of the *North East Constructing Excellence* that engage in various improvement programmes.

1.3 Research Goals

1.3.1 Purpose

This study is an inquiry into the inner practices of organisational learning within the construction companies setting. The main purpose is to map and model different practices for managing internal and external learning among selected construction companies. This study also investigates the practice of sharing and storing learning within the individual companies. This involves the examination of various learning mechanisms utilised by the companies in order to facilitate the capture of learning generated from internal as well as external sources and to disseminate that learning across organisational members or units.

1.3.2 Proposition

From the stated purpose, three propositions are made:

- (1) There is a variation in the learning strategies and learning profiles adopted by construction companies.
- (2) Successful construction companies use different combinations of learning mechanisms.
- (3) Construction companies' use of a set of sharing mechanisms is contingent on the nature of basic organisational features such as company size and geographical dispersion, as well as on the characteristics of works in which the company specialises.

Central to the development of this thesis is the assumption that “all organisations learn” following the tradition established by Kim (1993) who argues that,

“All organisations learn, whether they consciously choose to or not – it is a fundamental requirement for their sustained existence. Some firms deliberately advance organisational learning, developing capabilities that are consistent with their objectives; others make no focused effort and, therefore, acquire habits that are counterproductive. Nonetheless, all organisations learn” (Kim, 1993: 37).

This is reflected in the methodology designed for the purpose of the current research (see methodology sections). Part of the investigation is to examine two different groups of company segregated according to their learning competence scores.

1.3.3 Objectives

In order to achieve the purpose, the research has focused on the following objectives:

- To examine generic organisational learning models that explain the process of learning in a company;
- To establish a framework for assessing organisational learning of construction companies;
- To identify various learning mechanisms that contribute to learning of construction companies;
- To evaluate the practice of knowledge acquisition, sharing, and storing through the evaluation of each learning mechanism practiced by construction companies;
- To develop a model for mapping the practice of learning of construction companies;
- To evaluate the proposed model; and
- To propose a taxonomy of construction company learning.

1.4 Scope of Research

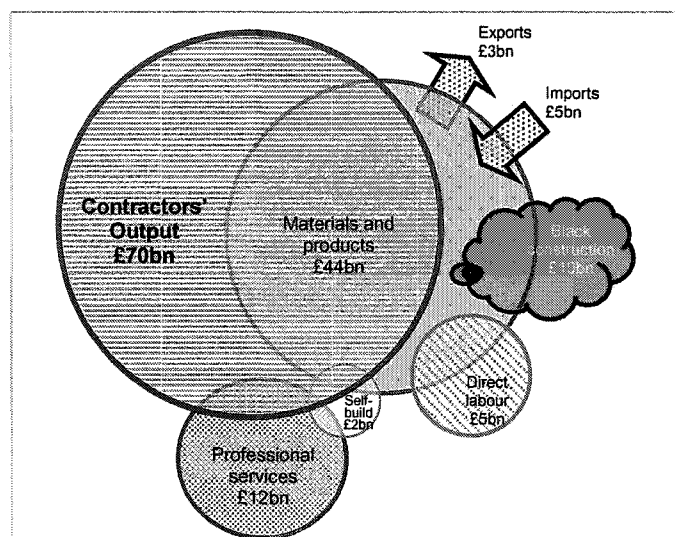
The research is aimed at a relevant sample of construction companies operating in North East England. The participating companies were selected from the active members of the *North East Constructing Excellence* that engaged in various performance enhancement programmes.

The scope of this research is limited to the UK construction industry due to the need to obtain company specific information and to conduct interviews and company visits. Furthermore, this research focuses primarily on evaluating the use of learning mechanisms at individual companies rather than in the industry as a whole. Thus, only the aspects of learning at the company level are considered. However, the evaluation

method resulting from this work could be used in further research on an industry wide level.

In the present study the terms ‘construction companies’, ‘construction organisations’ and ‘construction contractors’ are used interchangeably, all to mean a single class of enterprise within the construction industry that engages in construction contracting businesses. This includes general trade contractors and specialty contractors of various trades. The selection of only a single industrial group reflects the desire to reduce the number of variable involved in the analysis, thus making the study distanced from the effect of generalisation bias. Moreover, the choice of this particular group of companies is predicated by the primacy of contracting businesses in the construction industry. Contractors represent the largest single group of enterprises in the construction industry (Pearce, 2003). Their output alone accounted for around two thirds of the overall gross industry output (see *Figure 1.3*) and they also take the largest value of any given construction project, sometimes even taking full control over the overall project processes such as in the case of design and build contracts.

Figure 1.3
The overall gross output of the UK construction industry
(Source: Pearce, 2003)



1.5 Justification of Research Methodology

There are generally three key approaches to research: quantitative, qualitative, and mixed methods (Creswell, 2003). The choice of research method depends on the type of study, the research goal and its corresponding setting. The design determines the strategy and the data collection process as well as the appropriate tools for data analysis. Research methods are neither good nor bad (Silverman, 2000: 1). However, each research method has its own advantages and disadvantages. Qualitative research usually achieves a greater level of depth and detail than quantitative methods, especially in an ethnographic study. However, due to its intrinsic subjective biases it is often regarded as being “unscientific” (Popper, 1992) and “anecdotal” (Bryman, 1988). Results from a qualitative study are also more difficult to aggregate due to the lack of structured design or standardised procedures (Mason, 2002). In contrast, the use of structured measures in quantitative research permits for greater objectivity and accuracy of results. Standardised approach to data collection means allow the scope for replication and the results therefore can be compared. However, the use of standard questions by itself limits the breadth of investigation and is often criticised as being prone to “structural bias” and false representation of reality (Silverman, 2000).

Following a suggestion put forward by Raftery *et al.* (1997) who advocate the use of mixed methods to construction management research, the present study adopted a *combined methodology* approach where different data collection strategies and analyses were used at different stages of the research. Both quantitative and qualitative data were gathered and both objective and interpretative information were analysed. Moreover, the research adopted both a survey methodology and a multiple-case interviews approach as prime research strategies.

At the first stage of data collection, *questionnaire surveys* were used as justified by the nature of data required and the number of samples engaged in the research. Questionnaire surveys allow a greater number of samples to be approached and the same kind of data to be gathered (Saris and Gallhofer, 2007). The main objective at this stage was to identify a comparable group of companies that could be analysed in greater depth. Therefore, the choice of questionnaire surveys surpassed the other alternative methods available.

At a later stage, an in-depth investigation involving smaller number of systematically selected companies justified the use of *interviews* as the primary data collection method. Interviews allow respondents to provide rich, contextual descriptions of events (Byrne, 2001). However, since the primary research goal was to test the already known concept to be applied in different setting, *structured interviews* were chosen with the desire to reduce response variation as well as to allow for replication of the interview with multiple interviewees. This way, some patterns in the data are expected to emerge and comparison can therefore be made. In an effort to improve the richness of information, some elements of qualitative investigation through *open-ended questions* were administered as complementary to the main structured questions. Unlike the less structured interview methods, structured interviews are very quick to administer, easily replicated, produce generalisable results, and characterised by low influence from interpersonal variables as well as high reliability (Coolican, 1999: 122). Additionally, the need to obtain 100% responses with fully answered questions from the predefined respondents also justified the use of interviews in contrast to the use of self-completion questionnaires. In a self-completion questionnaire, it is possible that if a question is misunderstood, it may be skipped or not answered properly, thus reducing the validity of the information. It is at this tenet that face-to-face interviews were chosen as a primary data collection method to allow some clarifications and direct communication.

In summary, the adoption of mixed methods using both questionnaire surveys and structured interviews in this research was justified by the reasons mentioned above. In addition to that, according to Maxwell (1998: 93), the use of multiple data collection methods reduces the risk of systematic distortions inherent in the use of only single method.

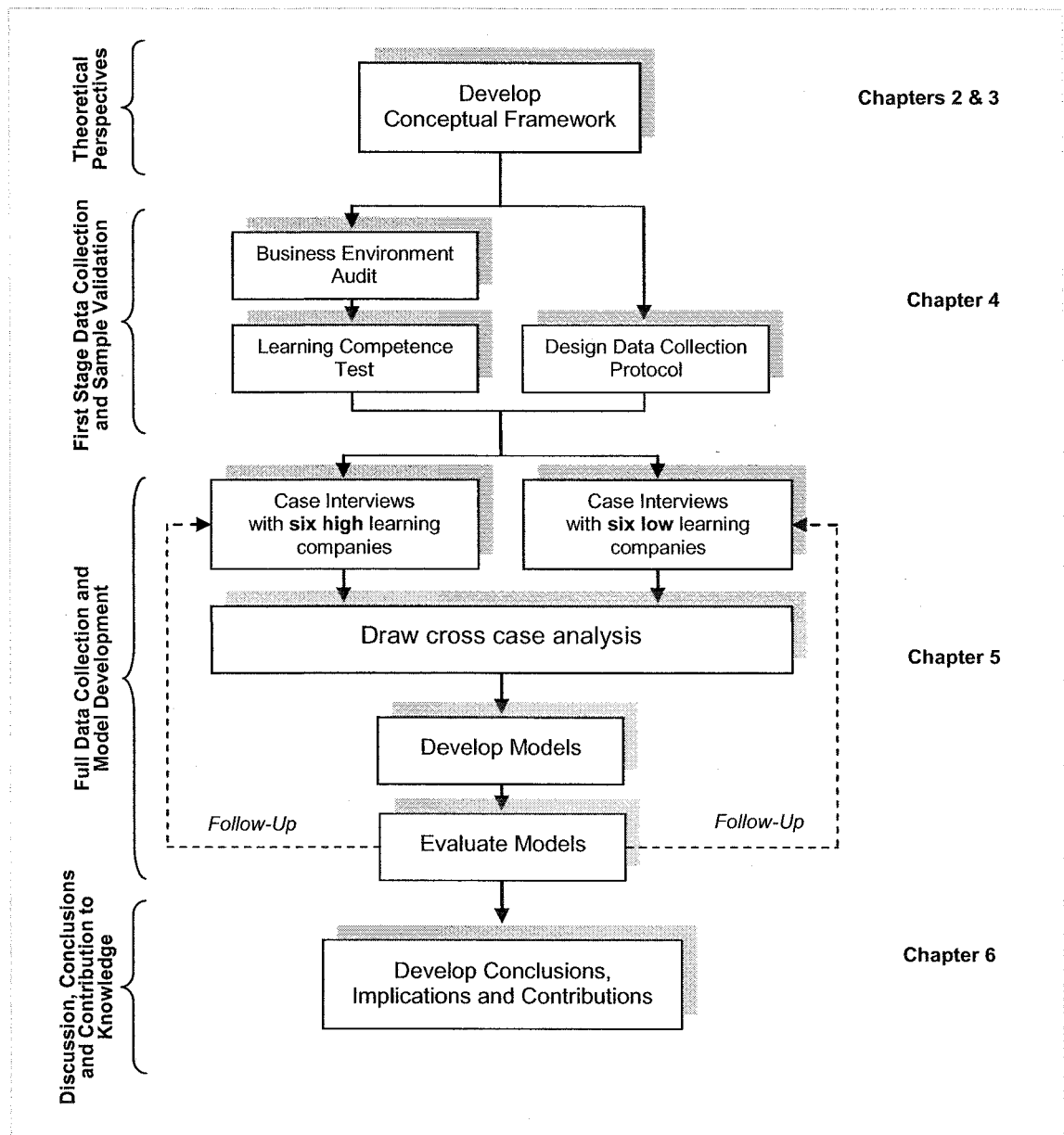
From a philosophical perspective, the paradigm that is followed in this study is essentially positivist in nature. Underlying positivism is the assumption that the researcher can be a neutral or objective observer, detached from feelings and motivations that might influence interpretation (Hollifield and Coffey, 2006: 575). Therefore, the design of this research is predominantly set out to achieve maximum objectivity through quantifiable observations which ultimately lead to the adoption of questionnaire surveys and structured interviews.

1.5.1 Research Design

Every type of empirical research has an implicit, if not explicit, research design. The aim of a research design, according to Mouton and Marais (1990: 33), is to plan and structure a given research project in such a way that the eventual validity of the research findings is maximised. A research design is also a measure to avoid a situation in which the evidence does not address the research question (Yin, 1994).

The full research design used in this study is provided in *Figure 1.4*. The choice of analysis strategy in the primary investigation was based on what Yin (1994) refers to as the replication logic – an approach he explains as being analogous to the logic used in multiple experiments. The replication approach used in the present multiple-case companies is illustrated in *Figure 1.4*. As can be seen from the graph, the initial step of research involved the establishment of the theoretical perspectives followed by the development of a conceptual framework that underpins the research. These are covered in Chapters 2 and 3, respectively. This procedure was then followed by a sample validation process in the form of a business environment audit and a learning competence test. The procedure and results of these processes are detailed in Chapter 4. These processes of sample validation were conducted in parallel with the design of the full data collection protocol. Next, an in-depth and fuller data collection process was conducted involving 72 managers from 12 construction companies. Cross-case analyses and cross-group evaluations were made based on the process of replication logic or pattern-matching, similar to that used in multiple experiments (Yin, 1994). In the model development stage, the model that was developed based on the practice of high learning companies was evaluated against the results from low learning companies. Follow-up evaluation involved sending the model to directors/managers of construction companies for an accuracy check and usefulness test. At the end of the research process, conclusions were made and implications for theory and practice were established.

Figure 1.4
Research design (Modified and developed from Yin, 1994)



1.5.2 Theoretical Perspectives

The purpose of establishing theoretical perspectives was to provide a sufficient and necessary level of background knowledge pertaining to organisational learning theories and practices. This was carried out through an extensive literature search on the generic organisational learning concepts, supplemented by a number of construction specific research studies. Building on this rich theoretical background established in Chapter 2, a conceptual framework and hypotheses were then developed and are presented in Chapter 3.

Sources of Literature Search

An extensive search of the international and national literature was conducted using various databases including:

- Blackwell Synergy
- Business Insights
- Business Source Premier (EBSCO)
- Emerald
- IngentaConnect
- Journal Citation Reports (JCR Web)
- Northumbria University Library Catalogue
- Oxford reference Online
- Science Direct
- Swetswise
- Wiley Interscience
- NORA (Northumbria University's data base system).

Such treatment was intended to ensure that the search was multidisciplinary. However, it was anticipated that the subject areas covered in the literature search focusing on the organisational learning, learning organisations, knowledge management, learning management, and strategic management that are associated with concepts of company learning (Walsh *et al.*, 1997; Truch, 2004). Key words that were used to search the databases included learning, organisational learning, learning organisation, organisational knowledge, learning mechanisms, formal learning, informal learning, construction, construction industry, and construction companies.

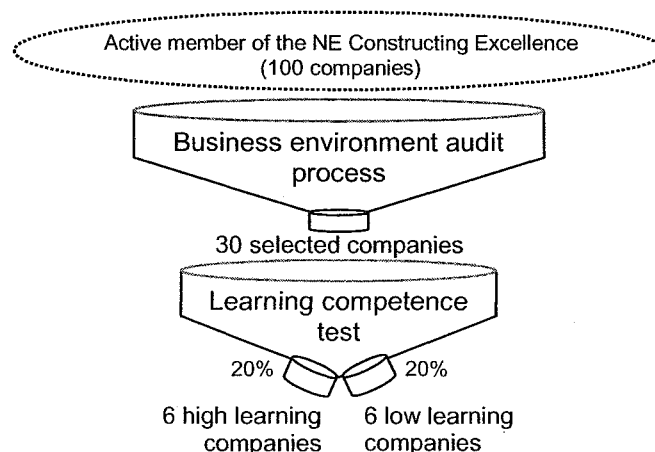
1.5.3 First Stage Data Collection and Sample Validation

As portrayed in *Figure 1.4*, the full research process developed through several stages. In the first stage data collection, a *business environment audit* and a *learning competence test* were conducted to establish a reliable sample for the research. Data were collected to establish general information about the internal and external business environments of construction companies, such as their position in the market and their project management practices. This was followed by further data collection, measuring the level of company learning in the sample companies. The results of the first stage data collection and sample validation are presented in Chapter 4.

Sample Validation Processes

The conduct of sample validation for this study consisted of two procedures. The first procedure involved a *business environment audit* targeting 100 prospective companies. This was undertaken through a survey methodology in which 32 construction companies participated. The results of the survey facilitated the purposive sampling in the second procedure, namely, the *learning competence test*, involving 30 selected companies. The latter procedure subsequently produced two smaller groups of case companies that were later involved in the full data collection process. The first group, referred to as the '*high learning companies*', consisted of six companies (20% of the total sample) that exhibited the greatest correlation with a set of learning competence criteria. The second group, referred to as the '*low learning companies*', consisted of six companies (20% of the total sample) that showed the least correlation with the learning criteria. *Figure 1.5* illustrates the process of sample validation for this study.

Figure 1.5
Illustration of screening process for sample validation



Justification of the Sampling Frame

Two types of sampling method are cited in literature, namely, random and non-random sampling. Random sampling refers to sampling procedures that give every element of a population an equal chance of selection, whilst non-random sampling deliberately targets candidates within a population (O'Leary, 2004).

Since the aim of this study was to develop a model of organisational learning by 'excellent companies', the sample could not be purely random. The prime intention was not to represent the generic model at industry level but to establish a typology of practices by individual excellent companies as good practice models. As such, the sampling frame was confined to construction companies that engaged in various performance improvement programmes. Notably, such companies were likely to be found in the members of the *CONSTRUCTING EXCELLENCE* initiative. It was also considered necessary to focus on the geographical location of the companies within the North East area to allow company visits and field interviews.

Thus, the reasons for a focus on this targeted population were twofold. First, it helps to set the boundary limit, geographically. Second, it was intended to overcome the problem related to the variable nature of the construction sector in terms of companies' profiles and sizes. Exceptional companies that have invented their own learning traditions hardly exist within the industry. It was expected that the active members of *CONSTRUCTING EXCELLENCE* would probably represent the few construction companies that possessed good learning practices.

*CONSTRUCTING EXCELLENCE*¹: AN OVERVIEW

Constructing Excellence is a national initiative under which the Construction Industry and the Government are working together to improve UK construction performance. Constructing Excellence members are corporate and entrepreneurs who have the vision of continuously improving their business performance. It currently has 12 regional centres and over 30 local clubs across the UK. A Constructing Excellence Club is a forum for individuals to learn about the principles of Best Practice, whilst creating the culture and local support networks for continuous improvement. They are informal

¹ www.constructingexcellence.org.uk

groups of forward thinking and innovative people, learning from each other and sharing their knowledge with the view of improving business performance.

Given this definition, it was therefore justifiable to assume that the active members of the *North East Constructing Excellence* were probably among the best companies in the region that could be expected to exhibit some effective learning practices for the purpose of model development.

Justification of Sample Size

Whilst a larger sample size would be desirable, a minimum of 30 sample companies was sought to comply with the rule of thumb for sample size set out in Roscoe (1975). The rule says that sample sizes of no less than 30, but no more than 500, are appropriate for most research. In fact, samples larger than 30 ensure the benefits of the *central limit theorem* (Abranovic, 1997: 307–308). The *central limit theorem* implicitly states that the means of large samples (*i.e.* 30 or over), tend to be normally distributed.

In association with the *North East Constructing Excellence* office, a list of 100 companies that were actively involved in various performance improvement programmes was identified to form a sample frame for this study. As a result of the sample validation process (see *Figure 1.5*), 30 companies were selected in accordance with a set of established criteria. The two most basic criteria were that the companies were willing to participate in the full data collection and that they employed more than 50 employees to allow rich analysis of the formal behaviour of the company, such as structured learning mechanisms. Prior research by Kululanga *et al.* (2001) and Love *et al.* (2004) noted that smaller construction companies proved difficult to study owing to the lack of a formal structure, systematic processes, and documentation. Kululanga *et al.* (2001) required construction companies that had at least 80 employees for the samples of their study and Khadra and Rawabdeh (2006) required companies with over 50 employees for their learning assessment study.

Willingness to participate was a crucial aspect in the selection process due to the sensitive nature of the subject under study. It often deals with issues of confidential strategies that shape the current and future position of the company. Therefore, the ultimate number of companies selected reflected considerations of company size and the accessibility of targeted management personnel.

1.5.4 Full Data Collection and Model Development

Following the first stage of data collection, an in-depth investigation was conducted involving 12 case companies selected from the total sample of 30 companies. Six were selected from the category of high learning companies and another six were from the category of low learning companies. Empirical data were collected through the assessment of the practice of various learning mechanisms by the high and the low learning companies. The objective was to develop a best practice model that may be useful in providing a benchmarking for organisational learning of construction companies. The results are presented in Chapter 5 followed by analyses and the presentation of findings.

Justification of Data Collection Methods

In the full data collection, multiple case investigations were undertaken to establish some patterns of similarities and differences across cases of construction companies (Ragin, 1994). To this end, the chosen format of interviews was primarily *structured*. The aim was to ensure that each interviewee was presented with exactly the same question in the same order. This way ensures that responses can be reliably aggregated and that comparisons can be made with confidence between case companies and between case groups, or between interviewee subgroups. *Open-ended* interviews were used in matters of opinion or for the verification of information provided from the structured interviews conducted in each company.

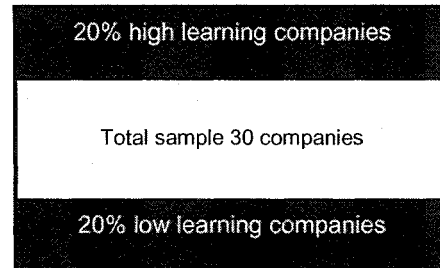
Justification of the Number of Cases

The number of cases or samples involved in the full data collection stage was discretionary, but systematically chosen based on the analogy made by Yin (1994) of statistical studies in choosing the level of significance. Yin notes that much of the choice of “ $p < 0.05$ or $p < 0.01$ ” is not derived from any formula but is a matter of discretionary, judgmental choice. The selection of the number of replications depends upon the certainty the researcher wants to have.

This study considers that 20% samples from both extreme situations – the highest and the lowest learning performer companies – should be more than adequate for the present problem being studied. As far as the research quality is concerned, the researcher believes that by adding more cases in the present study would not have a significant

influence on the outcome of the research. *Figure 1.6* illustrates the percentage proportion and the origins of the two groups of case companies in the sample frame.

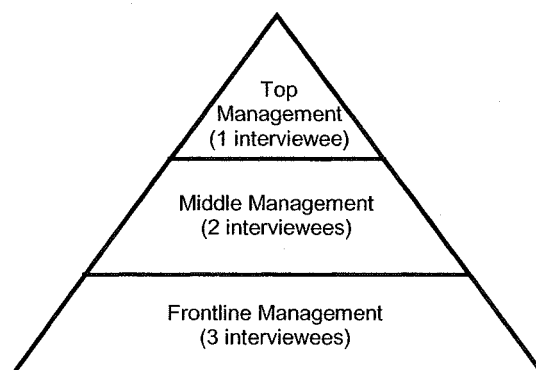
Figure 1.6
Origins of the sampling companies



Justification of Research Participants

The research participants were targeted to cover three organisational layers and each case company was assigned the same number of interviewees, that is, six per company. For each company, there is one interviewee from top management, two interviewees from middle management, and three interviewees from frontline management levels. *Figure 1.7* illustrates the pyramid of research participants involved in the full data collection process. Since the main objective of the research was to analyse the practice of organisational learning at company level, it was considered justifiable to focus the investigation on assigned managers at three different organisational layers, rather than simply on a random selection of employees.

Figure 1.7
The three-layer data collection approach



This three-layer data collection design was intentionally planned to gather data on the same topics from different hierarchical levels in the company. According to Prencipe

and Tell (2001), such a treatment allows the identification, evaluation and matching of patterns within individual cases, thus strengthening the *internal validity* of the research. A similar strategy has been adopted by Bourgeois and Eisenhardt (1988) on the study of the strategic decision process. In addition, the use of multiple-case investigations involving 12 companies permitted the adoption of Yin's (1994) replication or pattern-matching strategy to establish the *external validity* of the research.

Figure 1.8 explains the number of case interviews and participants' roles in the organisational layers.

Table 1.1
Number of research participants by position

<i>Organisational layer</i>	<i>Job title</i>	<i>No. of case interviews</i>
Top management	Director, Regional manager	12
Middle management	Contract manager, project manager	24
Frontline management	Site manager, site supervisor, site engineer	36
<i>Total</i>		72

Guard Against Bias

Every effort was made in the course of interviews to avoid possibilities of bias that may influence the quality of data in the present study. The researcher was aware of avoiding prejudice stemming from either the researcher or the respondent. The former was abated by the use of a well designed research protocol (see *Appendix 3*). The latter bias was controlled by translating the managers' thoughts into the theoretical perspectives established in this study.

Data Analysis and Presentation

Two main data analysis strategies were used in this study: statistical data analysis (Roscoe, 1975) and (interpretative) pattern-matching analysis (Yin, 1994). Non-parametric techniques were used for the former because the data did not satisfy all the assumptions of the parametric tests. According to Siegel and Castellan (1988), non-parametric techniques are normally used for analysing and testing hypotheses where data are not normally distributed and samples are considered small.

In addition, various presentation tools were employed in support of the data analysis process and interpretation of findings, including the use of gap analysis, matrices, tabulations, bar-charts, and radar diagrams.

Model Development and Evaluation

In the model development stage, the profiles of organisational learning practice of 12 construction companies were compared and pattern-matched. The best cases of construction company learning were then selected and further analysed for the purpose of best practice modelling. Finally, in the model evaluation stage, the process involved sending the model to 12 directors/managers of construction companies and four follow-up questions were asked, mainly to evaluate the accuracy and the usefulness of the proposed model.

Validity and Reliability

According to Yin (1994), the tests for measuring the quality of a research include: *external validity*, *internal validity*, and *reliability*. Since Yin also identified relevant stages in the research process where such tests could be carried out, the following section explains how the quality of the research design for this investigation was tested.

- (1) *External validity* – this test deals with the problem of knowing whether the research's findings are generalisable across populations, contexts and time (Birnberg *et al.*, 1990). External validity in this research was established through both analytical and statistical generalisations. The former strives to generalise the findings to a broader theory, that is, through comparisons with existing theories. The adoption of the pattern-matching approach has also increased the external validity of this research. This makes a generalisation of results from the sample to a larger population of UK construction companies (Yin, 1994). It should be noted, however, that the main objective of this study was not to represent the UK construction industry as a whole.
- (2) *Internal validity* – this test refers to the credibility of the causal relationships between independent and dependent variables inferred from the data (Birnberg *et al.*, 1990). Internal validity of this research was achieved through triangulation of different sources of data, employing a three-layer data collection approach, having selective sampling through a systematic validation process, and having

the directors/managers of each company check the accuracy of their company's learning profiles resulting from the data analysis. Modell (2005) states that the triangulation approach to data collection could mitigate the difficulties in advancing at least plausible causal explanations.

- (3) *Reliability* – the reliability measure was attained through a structured data collection approach guided by data collection protocol, consistent data analysis procedures, and comparison of findings of each case company.

1.5.5 Discussion and Conclusions

The final stage of the research process concludes with a discussion of the main findings in the context of existing theories and proposed hypotheses. This includes some reflections on the possible implications to the wider perspectives of UK construction companies.

1.6 Chapter Conclusions

This chapter provided a background to the thesis topic, set out the problem statements and justification of the research. The mapping out of the current challenges facing the UK construction industry provided a first step towards understanding the need for learning and improvement in UK construction companies. Research is needed to help the managers of construction companies to be better equipped with a management tool for benchmarking the organisational learning practices in their companies.

Justifications regarding the choice of research methods, sampling strategies, sample size, data collection techniques and data analyses were established in the final section of this chapter. In the next chapters, the results of both the theoretical studies and the empirical studies are presented in accordance with the research design developed in *Figure 1.4*. These are organised as follows:

Chapter 2: Theoretical Perspectives

Chapter 3: Conceptual Framework and Hypotheses

Chapter 4: First Stage Data Collection and Sample Validation

Chapter 5: Full Data Collection and Model Development

Chapter 6: Discussion, Conclusions and Contribution to Knowledge

2. Theoretical Perspectives

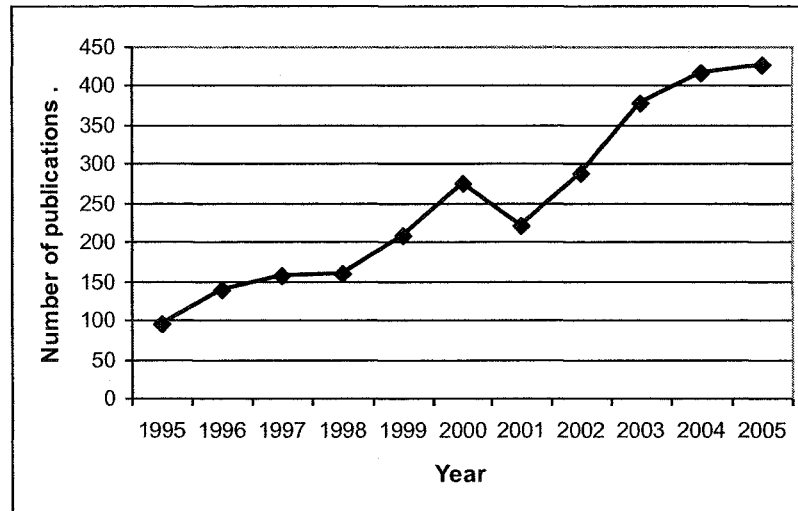
*Without learning, the wise become foolish;
by learning, the foolish become wise.*

-Confucius (551-479 BC)

The above quote brings to light the importance of learning to mankind. Learning is an ancient word that has never lost its significance over time. Just as learning is essential for the growth of individuals, it is equally important for organisations. Learning has also been associated with survival (Deming, 1986; Pedler *et al.*, 1997: 6; Montuori, 2000; Garrat, 2000). Today, most modern organisations hold a common belief about the significance of learning as a central source of competitive advantage (Stata, 1996; Senge, 1990; Chandler, 1992; Moingeon and Edmondson, 1996; DeGeus 1996; Probst and Buchel, 1997). For Zuboff (1988: 395), “learning is the new form of labour”. The search for knowledge on the nature of learning shifted from merely individual human cognitive phenomenon to organisational. Such a development has given birth to a new research discipline known today as *organisational learning*.

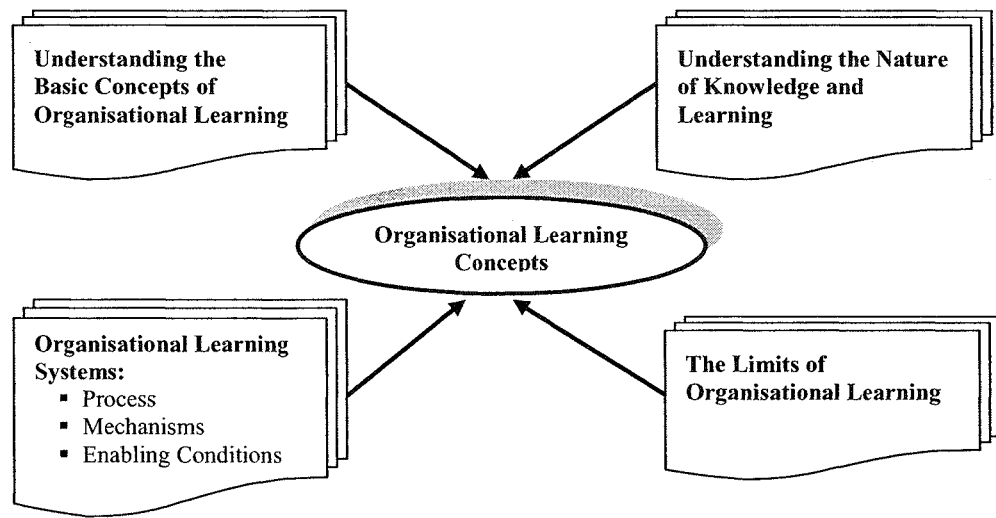
The notion of ‘organisational learning’ stemmed from the work of Cyert and March (1963), who first used the term to describe the adaptive changes of organisational routines based on the experiences of the organisation. Since then, the concept has been developing in a wide range of disciplines attracting both the academic and the business community (Easterby-Smith and Araujo, 1999; Easterby-Smith *et al.*, 1998). The conceptual exploitation of the term remained fashionable in academic publications during the recent decades as the burgeoning literature on organisational learning bears witness. *Figure 2.1* shows the still-growing numbers of academic articles published in the Business Source Premier [EBSCO] database containing keywords “organisational learning”. The concept has assumed mainstream importance in the field of organisational studies in recent years (Easterby-Smith *et al.*, 1998). From an academic perspective, it has even been claimed that organisational learning as a research domain is now fully established (Easterby-Smith *et al.*, 2000: 783).

Figure 2.1
Number of academic publications in the Business Source Premier [EBSCO] database containing keywords “organisational learning” (searchable through Northumbria University’s NORA system)



Due to this surge of interest in the concept of organisational learning, generous stocks of literature are now available. Additionally, there exists a wealth of material and research in areas adjacent to organisational learning such as organisation studies, organisational behaviour, learning theories, knowledge management and strategic management. Therefore, the challenge of developing this chapter lies in maintaining a focus on and staying within the boundaries of the current research project, particularly in providing sufficient theoretical background to underpin the research. The objective of this chapter is to provide a sufficient and necessary level of background knowledge about organisational learning theories, whilst focusing on those constructs that are applicable to the current research. In so doing, the discussion throughout this chapter is set to follow strictly under four parent themes as reflected in *Figure 2.2*.

Figure 2.2
Parent themes that make up this chapter



The chapter begins with an overview of the basics of organisational learning including a brief discussion on the origin of the concept and a presentation of two different research traditions followed by organisational learning definitions, together with a succinct discussion about some conceptual agreement among theorists of organisational learning. Section 2.2 presents different types and levels of learning followed by a discussion on the characteristics of learning organisations in Section 2.3.

Section 2.4 aims at providing a basic understanding of the nature of knowledge, learning, and memory and their relation to organisational learning. Section 2.5 introduces the concept of organisational learning systems. Section 2.6 sets a foundation for understanding the process of organisational learning. Section 2.7 examines various learning mechanisms that support different learning processes. Section 2.8 identifies thirteen learning enablers that set the preconditions for effective organisational learning. The chapter concludes with a concise discussion on three undesirable phenomena that highlight the limits of organisational learning.

2.1 Organisational Learning: An Overview

A belief that the possession of the right knowledge can bring a company to operate more efficiently, produce better products or deliver superior services has been accepted by many theorists for as long as over 230 years ago when Adam Smith wrote *An Inquiry into the Nature and Causes of the Wealth of Nation* (Truch, 2004: 1). In his writing, Adam Smith mentions that “a firm organised around processes based on the specialised content of knowledge may gain efficiencies in producing a physical product” (Adam Smith, 1776 as cited in Truch, 2004). It is widely accepted that the method of acquiring knowledge is through learning and experience. Acquiring knowledge is, however, only the first step toward learning (Huber, 1991), for true learning cannot exist unless followed by action (Senge, 1990; Gredler, 2005) that results in change of performance. Thus, learning is the process of improving actions through better knowledge and understanding (Fiol and Lyles, 1985: 803).

Learning theories have their origin in the studies of individual human learning and this led Simon (1991: 125) to argue that “all learning takes place [only] inside individual human heads”. Obviously, any attempts to theorise learning from an organisational perspective are heavily overshadowed by the use of the individual learning metaphor (e.g. Argyris, 1977; Argyris and Schön, 1978; Andrews and Delahaye, 2000). Even theorists from the social-process point of views, who hold that organisational learning is a socially enacted process, also maintain the principality of the individual in learning (e.g. Lave and Wenger, 1991; Brown and Duguid, 1991; Gherardi and Nicolini, 2000). However, current development has been debating whether organisational learning can actually exist in its own right and be more than just the sum of individuals’ learning (Fiol and Lyles, 1985: 804; Dodgson, 1993). Theorists have shown that learning at the organisational level occurs through shared insights and mental models (Argyris and Schön, 1978; Senge, 1990; Cook and Yanow, 1993; Sense, 2003) and builds on the past knowledge and experience of the organisation’s members (Stata, 1996). Over time, the knowledge possessed by an individual may spread to other individuals in the organisation and, indeed, to other organisations. Knowledge may then be stored in the organisational memory (Walsh and Ungson, 1991; Ozorhon *et al.*, 2005) in the form of files, manuals, policies, procedures, routines, *etc.* for retrieval and use. It should not be assumed that organisations behave like individuals. As Hedberg (1981: 3) points out, “organisations do not have brains, but they have cognitive systems and memories...”

Members come and go, and leadership changes, but organisations' memories preserve certain behaviours, mental maps, norms, and values over time".

This school of organisational theories agrees that learning can occur through different levels. The learning of individuals is important to an organisation, but the link between individual and organisational learning is often *the team*. This relationship was examined by Cangelosi and Dill (1965) and led to their suggestion that learning occurs at all three levels – individual, group (team), and organisation. The learning of individuals can only become organisational if shared among the organisation's members. Therefore, there is a commonly held principle that in order to support organisational learning, a company should (1) create continuous learning opportunities, (2) promote inquiry and dialogue, (3) encourage collaborative and team learning, (4) establish systems to capture and share learning, (5) empower people toward a collective vision, and (6) connect the organisation to its environment (Watkins and Marsick, 1993).

2.1.1 Organisational Learning Research: Descriptive versus Normative

Robinson (2001) presents two distinct strands of research on organisational learning. The descriptive strand seeks to understand the processes by which organisations learn and adapt, and the normative strand, which is concerned more with how organisations can direct their learning in ways that bring them closer to an ideal. Earlier researchers who have made distinctions between descriptive and normative views of organisational learning studies are Romme and Dillen (1997). Sun and Scott (2003) agree, and describe the former as 'organisational learning' and the latter as 'learning organisation'. Organisational learning is the learning process used in the organisation, and an organisation skilled at organisational learning is called a learning organisation. Theorists tend to equate Argyris and Schön with organisational learning theory and Peter Senge with the learning organisation concept (*e.g.* Sun and Scott, 2003; Gorelick, 2005). It is true that Argyris and Schön (1978) have provided a conceptual groundwork for describing how an organisation learns, whilst Senge (1990) has borrowed this descriptive theory and develop it into a normative account prescribing how to become a learning organisation. Senge (1990) defines a learning organisation as a dynamical system that is in a state of continuous adaptation and improvement. The learning organisation is the organisation "in which you cannot *not* learn because learning is so

insinuated into the fabric of life”. Thus, practically, the distinction between organisational learning and learning organisation may seem unimportant given that all organisations learn, whether the learning is positive or negative (Kim, 1993). Various definitions of organisational learning and a learning organisation are given in Section 2.1.2.

According to Sun and Scott (2003) and also Örtenblad (2001), researchers once used these terminologies interchangeably (*e.g.* Boje, 1994; Hawkins, 1994; Crossan and Guatto, 1996; and Denton, 1998), but the two streams bifurcated in the middle 1990s with definitions offered to differentiate them. Various definitions of these two terms are discussed in the next section. By contrasting two different accounts that came from descriptive and normative strands using the works of Argyris and Schön, Sun and Scott (2003) learn that these two accounts could be integrated by recognising that differing tasks or problems require different learning processes and different types of expertise. Such analysis casts doubt on the notion of a generically capable ‘learning organisation’. These authors then conclude with a call for more research to integrate the descriptive and normative strands of research on organisational learning leading to the development of integrated theory.

Nevis *et al.* (1995) were probably the first to have made such an attempt. By viewing organisations as learning systems, they developed an integrated model of an organisational learning system that consists of the learning orientations dimension – developed from descriptive theories, and the facilitating factors dimension – derived from normative theories.

2.1.2 Definitions of Organisational Learning and a Learning Organisation

A range of definitions of organisational learning and learning organisation have appeared in literature, reflecting the diversity of disciplines and points of view. Dodgson (1993) outlines the history and growth of organisational learning according to academic disciplines such as sociology, psychology and anthropology, whilst Easterby-Smith (1997) compares and contrasts the organisational learning literature based on the role of the researcher, the methodology used in empirical studies, the unit of analysis and the focus on learning. *Tables 2.1* and *2.2* present some notable definitions of organisational learning and the learning organisation drawn from the pool of literature.

Despite concerns by some scholars who claim that there is no clearly accepted definition of organisational learning (Huber, 1991; Easterby-Smith *et al.*, 1998; Crossan *et al.*, 1999), it can actually be observed from *Tables 2.1* and *2.2* that some concepts do appear to be complementary rather than contradictory. For example, the knowledge sharing view defines organisational learning as a process of sharing knowledge, beliefs or assumptions (Shrivastava, 1983). Although behaviourists agree, they specify that such a shared knowledge should have an effect on behavioural change (Slater and Narver, 1995). This is further shaped by the resource-based students who stipulate that the changes should lead to an increase in the organisation's capacity to take effective action (Kim, 1993: 43). The performance-based school adds more to these concepts by requiring the need for improved performance as a result of learning (Buckler, 1998: 16). In the light of these definitions, organisational learning can now be summarised as *a set of actions to acquire, share and retain knowledge in the context of everyday life of the organisation and where the main objective is to increase organisational performance through improved quality of decision making in the organisation*. This practical definition serves as the basis for understanding organisational learning developed in this thesis. Garvin (1993) argues that "a well-grounded definition of organisational learning should be easy to apply, readily measurable, and with operational advice rather than high aspiration".

Table 2.1
Organisational learning definition as provided by different authors

<i>Definition</i>	<i>Author</i>
Organisational learning is an adaptation process through which firms respond to the environmental changes by readjusting their goals, attention rules, and search rules.	Cyert and March (1963)
Organisational learning is a sporadic, stepwise, adaptive process that is the product of interactions among three kinds of stress, generating both individual and organisational level outcomes.	Cangelosi and Dill (1965)
Organisational learning is the growing insights and successful restructuring of organisational problems by individuals reflected in the structural elements and outcomes of the organisation itself.	Simon (1969)
Organisational learning is a process of detecting and correcting errors.	Argyris and Schön (1978)

To be continued

Table 2.1 (Continued)
Organisational learning definition as provided by different authors

<i>Definition</i>	<i>Author</i>
Organisational learning is a process through which members acquire and process information through interaction with their environments in order to increase their understanding of reality by observing the results of their action.	Hedberg (1981)
Organisational learning is a process of sharing knowledge, beliefs or assumptions developed through experience that directs adaptation of goals, selective attention to the environment, and search for solutions to problems.	Shrivastava (1983)
Organisational learning is a process of developing insights, knowledge and associations between past actions, the effectiveness of these actions and future actions.	Fiol and Lyles (1985)
Organisations are seen as learning by encoding inferences from history into routines that guide behaviour.	Levitt and March (1988)
A process that results in changed behaviour in ways that leads to improved performance.	Buckler (1998)
An entity learns if, through its processing of information, the range of its potential behaviours is changed.	Huber (1991)
Organisational learning is defined as increasing an organisation capacity to take effective action.	Kim (1993)
Organisational learning copes with the problem of balancing the competing goals of developing new knowledge (exploration) and exploiting current competencies (exploitation) in the face of dynamic tendencies to emphasise one or another.	Levinthal and March (1993)
Organisational learning is the intentional use of the learning process at individual, group and system level to continuously transform the organisation in a direction that is increasingly satisfying to its stakeholders.	Dixon (1994)
Organisational learning is a process of change in cognition and behaviour, and it does not necessarily follow that these changes will directly enhance performance.	Crossan <i>et al.</i> (1995)
Organisational learning is the development of new knowledge or insights that have the potential to influence behaviour.	Slater and Narver (1995)
Organisational learning is the acquisition of new knowledge by actors who are able and willing to apply that knowledge in making decisions or influencing others in the organisation.	Miller (1996)
Organisational learning is the process by which the organisation's knowledge and value base change, leading to improved problem-solving ability and capacity for action.	Probst and Buchel (1997)
Organisational learning is a process through which workers learn gradually in the work context through experience, reflection on work practice and collaboration with colleagues.	Mulholland <i>et al.</i> (2001)

Table 2.2
Definition of a learning organisation as provided by different authors

Definition	Author
A learning organisation is an organisation where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free and where people are continually learning to see the whole together.	Senge (1990)
A learning organisation is an organisation that is skilled at creating, acquiring and transferring knowledge and at modifying its behaviour to reflect new knowledge and insights.	Garvin (1993)
A learning company is an organisation that facilitates the learning of all its members and continuously transforms itself and its context.	Pedler <i>et al.</i> (1997)
A learning organisation is one that learns continuously and transforms itself.	Watkins and Marsick (1993)
A learning organisation is one that learns powerfully and collectively and is continuously transforming itself to better collect, manage, and use knowledge for corporate success.	Marquardt (1996)
A learning organisation is an organisation that creates systems for long term capacity to capture and create knowledge and empower continuous transformation.	Watkins and Golembiewski (1995)
A learning organisation is an organisation where learning is taking place that changes the behaviour of the organisation itself.	Reynolds and Ablett (1998)

Presenting the various definitions of organisational learning and learning organisation by different contributors helps to scale the depth and breadth of the existing body of research on the subject. According to Mitki *et al.*, (1997), the range of organisational learning definitions varies due to both discipline and focus: as knowledge acquisition, as adaptation, as skill learning, as development of knowledge base, as development of shared assumptions, and as institutional know-how. They believe that the differences in the concepts are both inevitable and necessary for the development of the theories. This is agreed by Easterby-Smith (1997) who argues against attempts to create a single framework for understanding organisational learning.

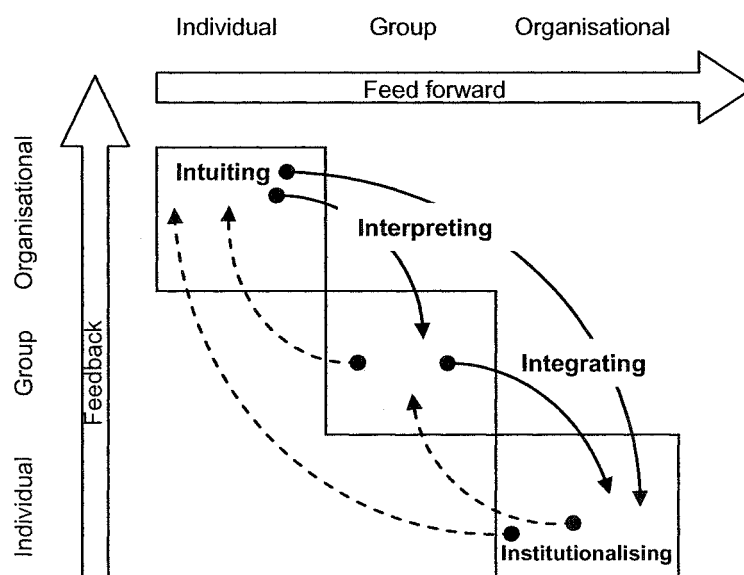
By considering the different definitions of organisational learning presented in *Table 2.1*, several important points of agreement emerged among the different authors. There is considerable agreement that organisational learning involves: (1) multilevel learning (individual, group, organisation), (2) that it requires inquiry, (3) that it results in shared

understandings, and (4) that it implies behavioural and/or cognitive change (Collinson and Cook, 2007).

2.1.3 Multilevel Learning

Crossan *et al.* (1999) provide interesting and important insights into organisational learning for the purpose of this thesis because they summarise extensively the linkage between learning at the individual, group, and organisational levels. These authors wrote: “there is a reasonable degree of consensus that a theory of organisational learning needs to consider the individual, group and organisational levels” (p.524). They further emphasise that organisational learning is indeed a multilevel process and it takes place at all of these three levels simultaneously (see *Figure 2.3*). According to their model, the links between individual, group and organisational levels are based on the four social and psychological processes of intuiting, interpreting, integrating, and institutionalising. Intuiting is as an individual level process, interpreting forms a bridge between the individual and group levels, integrating links the group and organisational levels, and finally, institutionalising takes place at the organisational level. Institutionalising is the true organisational learning process in the sense that it is the only stage where learning will be embedded in the organisational systems, processes and practices (Crossan *et al.*, 1999).

Figure 2.3
Multilevel learning as presented by Crossan *et al.* (1999)



2.1.4 Habits of Inquiry

Another area of general agreement involves inquiry as a necessary but insufficient condition for organisational learning (Collinson and Cook, 2007). According to Argyris and Schön (1978), organisational learning involves a process mediated by the collaborative inquiry of individual members. But this inquiry should become a collective norm for an organisation that aspires to become a learning organisation – an organisation that engages in not only single- but also double-loop learning. According to Collinson and Cook (2007), collective inquiry is closely linked to double-loop learning in that it has the capacity to restructure organisational norms and change prevailing practices or ‘theories-in-use’. “Double-loop learning consists not only of a change in organisational norms but also of the particular sort of inquiry into norms, which is appropriately described as learning” (Argyris and Schön, 1978: 29).

2.1.5 Shared Understandings

Organisational learning is about the collective process of knowing and improving. Thus, shared understanding is considered critical for the quality of learning (Senge, 1990). Shared understandings or shared mental models (Senge, 1990) or theories of action (Argyris and Schön, 1978) refer to mutual knowledge, mutual beliefs and mutual assumptions (Clark and Brennan, 1996). All organisations have shared understandings such as in the forms of routines that guide behaviour and decision making (Levitt and March, 1988). Shared understandings are generated and maintained through the continuing conversation among members of the community and through shared practice (Brown and Duguid, 1991). Hurley (2002) argues, “insight and innovative ideas occur to individual, not organisation, but learning is manifest in the organisation only when ideas are shared, actions taken, and common meaning developed at the group and organisation level”. He adds that “learning occurs through *ad hoc* [informal] and formal groups or communities of individuals; some shared understandings developed by groups of individuals become institutionalised in the organisation”. It is through such learning mechanisms that shared understanding or a collective mindset develops and mutual adjustment and negotiated actions take place (Crossan *et al.*, 1999).

2.1.6 Behavioural/Cognitive Change

Theorists agree that effective organisational learning by necessity results in either cognitive change or behavioural change or a conjunction of the two because, according to Leroy and Ramanantsoa (1997), behavioural change is merely a natural consequence of cognitive change. However, Starbuck (1983) in Leroy and Ramanantsoa (1997) argues that organisational changes are not necessarily caused by cognitive progress and regards the organisation as an action generator – a mechanism that has to act without the need for prior reflection. In effect, behavioural change may even trigger cognitive change to the contrary.

To sum up, a common agreement among contributors of organisational learning is to link it with cognition and action where it is suggested that for learning to take place at the organisation level, two conditions have to be met (Senge, 1990; Pedler *et al.*, 1991). First, information needs to be acquired and processed (Huber, 1991; Nevis *et al.*, 1995), and second, an outcome in terms of action has to occur (Probst and Buchel, 1997). For scholars such as Fiol and Lyles (1985), organisational learning involves changes both cognitive and behavioural. *Table 2.3* presents a content analysis of various organisational learning concepts by different contributors in order to delineate some commonalities in them.

Table 2.3
Content analysis to delineate some commonalities on
the concept of organisational learning

<i>Contributor</i>	<i>Focus of analysis</i>			<i>Change in</i>	
	<i>Individual</i>	<i>Group</i>	<i>Organisational</i>	<i>Cognition</i>	<i>Behaviour</i>
Cyert and March (1963)			√		√
Cangelosi and Dill (1965)	√	√	√	√	
Simon (1969)	√			√	
Argyris and Schön (1978)	√	√		√	√
Fiol and Lyles (1985)	√		√	√	√
Hedberg (1981)	√		√	√	√
Shrivastava (1983)	√		√	√	√
Fiol and Lyles (1985)			√		√
Levitt and March (1988)			√	√	√
Buckler (1998)			√		√
Huber (1991)	√		√		√
Kim (1993)	√	√	√		√
Levinthal and March (1993)			√	√	
Dixon (1994)	√	√	√	√	√
Crossan <i>et al.</i> (1995)	√	√	√	√	√
Slater and Narver (1995)	√		√		√
Miller (1996)	√		√	√	√
Probst and Buchel (1997)	√		√	√	
Mulholland <i>et al.</i> (2001)	√	√	√	√	
Senge (1990)	√	√	√	√	√
Garvin (1993)	√		√	√	√
Pedler <i>et al.</i> (1997)	√	√	√	√	√
Watkins and Marsick (1993)	√	√	√	√	√
Marquardt (1996)	√	√	√	√	√
Watkins and Golembiewski (1995)	√		√	√	√
Reynolds and Ablett (1998)	√		√		√

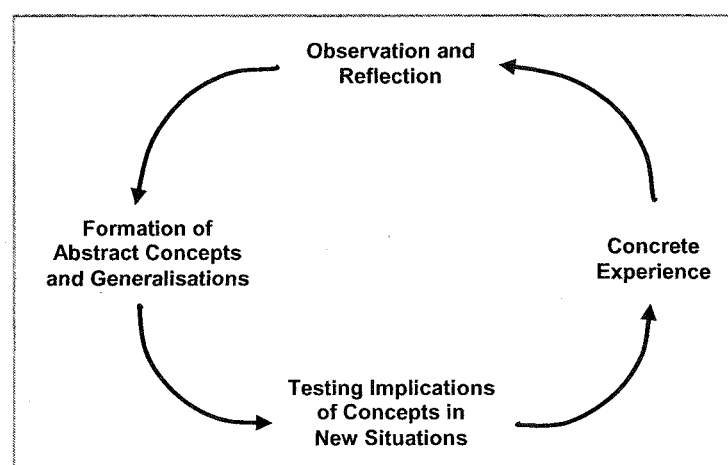
2.1.7 The Link between Individual and Organisational Learning

Learning by individuals in an organisational context is a well understood process. This is the traditional domain of human resources, including activities such as training, workplace learning, formal and informal education. All learning is necessarily begun from individual. Learning may be organisational to the extent that it is done to achieve organisational purposes, it is shared or distributed among members of the organisations,

and embedded in the organisations' systems, structures, and culture (Snyder and Cummings, 1998). Thus, individual learning is certainly a prerequisite to organisational learning (Argyris and Schön, 1978; Hedberg, 1981). Some theorists have contributed to establishing this relationship, for example Argyris and Schön (1978) and Levitt and March (1988). According to Argyris and Schön (1978), individual learning transcends to organisational when it becomes encoded in organisational theories-in-use. But for Levitt and March (1988: 320) individual learning becomes organisational when it modifies, creates or replaces organisational routines. Fiol and Lyles (1985: 804) provide quite a different perspective claiming that "organisations, unlike individuals, develop and maintain learning systems that not only influence their members, but are then translated to others by way of organisation histories and norms".

In broad terms, learning is defined as a process of acquiring new knowledge and skills (Hedberg, 1981). This process is carried out by individuals in an organisation. Thus, the learning of an organisation depends enormously on the skills, approaches and commitment of individuals to their own learning (Mumford, 1994: 77). Kolb (1984) suggests that individuals accumulate and experience learning in a cyclical process that revolves around: (1) concrete experience; (2) observation and reflection; leading to (3) the formation of concepts and generalisations; resulting in (4) the development of hypotheses that are to be tested in future action; leading in turn to new experiences. *Figure 2.4* depicts the cyclical process of experiential learning.

Figure 2.4
The Kolb's (1984) learning cycle



Kolb (1994: 21) explains the process in his model: “[it] begins with here-and-now experience followed by collection of data and observations about that experience. The data are then analysed and conclusions of this analysis fed back to the actors in the experience for their use in the modification of their behaviour and choice of new experiences”. Immediate concrete experience is the basis for observation and reflection. Observations are assimilated into a theory from which new implications for action can be deduced. Implications or hypotheses then serve as guides in acting to create new experiences.

According to Kolb’s (1984) model, learning is stimulated when an individual observes unintended consequences resulting from their existing practices or behaviours. Learning is said to occur through the resolution of conflicts over different ways of dealing with the world. In a similar vein, Argyris and Schön (1978: 16) state that “organisational learning occurs when individuals within an organisation experience a problematic situation and inquire into it on the organisation’s behalf. They experience a surprising mismatch between expected and actual results of action and respond to that mismatch through a process of thought and further action that leads them to modify their images of the organisation or their understandings of organisational phenomena and to restructure their activities so as to bring outcomes and expectations into line, thereby changing organisational theory-in-use”. In order to become organisational, as Argyris and Schön (1978) detail, the learning that results from organisational inquiry must become embedded in the images of the organisation held in its members’ minds, and/or the organisational artefacts such as rules, procedures and buildings.

Kim (1993) specifies that learning encompasses two meanings. The first is the acquisition of skill or *know-how* that implies the physical ability to produce an action. Second is the acquisition of *know-why* that implies the ability to articulate a conceptual understanding of an experience (p.38). Although learning may take place in planned or informal, and often unintended ways, the process of learning has three identifiable processes: knowledge acquisition, knowledge sharing, and knowledge utilisation as has been discussed elsewhere in the earlier section of this thesis.

There is still much debate in literature on whether an organisation can actually learn. Anders Örténblad (2005) challenges the views of those who believe that an organisation is incapable of learning, by arguing that an organisation should not be seen as an object,

but rather as purely a metaphor. In this way, Örtenblad argues, it should be possible to view an organisation as capable of learning in its own right although not necessarily separate from the individuals within it. In contrast, however, Hedberg (1981) maintains that organisations do not learn; members of organisations learn. To say that organisations can learn is tantamount to saying that the organisation has a brain. Hedberg (1981: 6) goes on and insists:

“Organisations do not have brains, but they have cognitive systems and memories. As individuals develop their personalities, personal habits, and beliefs over time, organisations develop worldviews and ideologies. Members come and go, and leadership changes, but organisations’ memories preserve certain behaviours, mental maps, norms, and values over time”.

In summary, it may be useful not to assume that an organisation is a separate entity capable of learning without the presence of individuals. An organisation ultimately learns by way of their individual members as the accumulation of new knowledge in an organisation is always initiated by the individuals (Kim, 1993). Nevertheless, the learning of individuals alone does not necessarily lead to organisational learning without embedding that learning into the system, which in turn will influence the learning of other members. Argyris and Schön (1978: 20) recognised this when they wrote: “there is no organisational learning without individual learning, and that individual learning is a necessary but insufficient condition for organisational learning”.

2.2 Types and Levels of Learning

Among the most important contributions to the study of organisational learning has been the explicit recognition that learning within a company occurs in many different varieties. As evidenced in the body of literature, some authors have contributed to the development of theoretical categories of organisational learning. Such categories might be present in or adopted by an organisation. *Table 2.4* below presents some of the most influential typologies of learning that appear in the literature. Brief descriptions accompany each category as shown below:

Table 2.4
Learning Types and Levels

<i>Authors</i>	<i>Classification of learning type or level</i>
Argyris and Schon (1978)	Single-loop learning Double-loop learning Deutero learning
Fiol and Lyles (1985)	Lower level learning Higher level learning
Senge (1990)	Adaptive learning (coping) Generative learning (creating)
Garratt (2000)	Policy learning Strategic learning Operational learning

2.2.1 Argyris and Schön's Classification of Learning

Argyris and Schön (1978) develop a three-fold typology of learning, any one of which might be the norm at a particular time in an organisation. Single-loop learning occurs when errors are detected and corrected, whilst the organisation carries on with its current policies and norms. Double-loop learning occurs when, in addition to detection and correction of errors, the organisation is involved in the questioning and modification of existing norms, procedures, policies, and goals. Detailing this process in their book, the authors write:

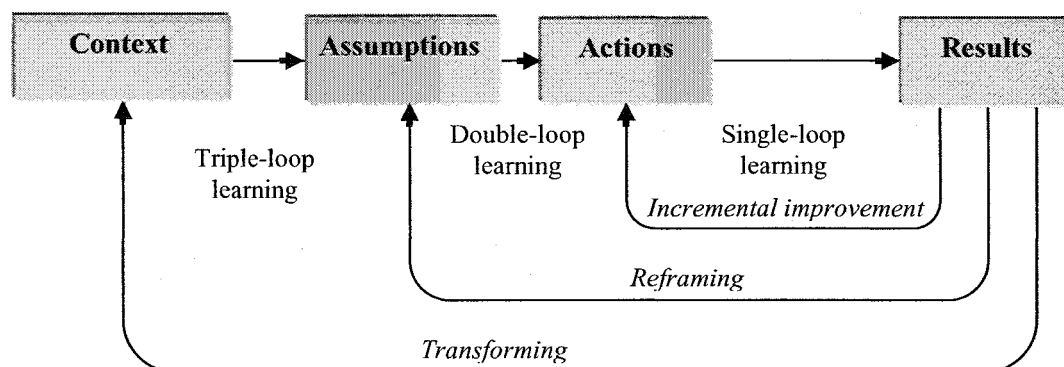
“When the error detected and corrected permits the organisation to carry on its present policies or achieve its presents objectives, then that error-and-correction process is *single-loop* learning. Single-loop learning is like a thermostat that learns when it is too hot or too cold and turns the heat on or off. The thermostat can perform this task because it can receive information (the temperature of the room) and take corrective action. *Double-loop* learning occurs when error is detected and corrected in ways that involve the modification of an organisation’s underlying norms, policies and objectives” (1978: 2-3).

According to Argyris and Schön (1978), single-loop and double-loop learning will not occur if the organisation is not aware that learning must occur. In other words, learning can only become productive if it is a result of design rather than chance. This requires an organisation to reflect upon its existing learning system and its effects on the organisation's inquiry. Such a process is called deuterio learning or triple-loop learning. Triple-loop learning involves questioning the rules, not only whether the rules should be changed. Triple-loop learning occurs when the organisation learns how to carry out single-loop and double-loop learning. Argyris and Schön (1978) explain,

“When an organisation engages in ‘deutero learning’ its members learn about previous contexts for learning. They may reflect on and inquiry into previous episodes of organisational learning, or failure to learn. They discover what they did that facilitated or inhibited learning, they invest new strategies for learning, they produce these strategies, and they evaluate and generalise what they have produced” (Argyris and Schön, 1978: 27).

Triple-loop learning aims to make a company exceptionally skilled at learning in order to meet the challenges posed by constant changes in the business environment. A company that nurtures triple-loop learning is capable not only of ‘doing things right’, but also ‘doing the right things’ as well as ‘doing the right learning’ (Chen, 2005). Using four constructs: context, assumptions, actions and results, the above process can be represented figuratively as shown in *Figure 2.5*.

Figure 2.5
Single-, double- and triple-loop learning (Probst and Buchel, 1997)



With reference to *Figure 2.5*, brief explanations are given. Single-loop learning occurs when a mismatch between the intended and actual results of an organisational action occurs and is corrected without questioning the assumptions that give rise to the actions and their expected result. Placing this within the context of a construction project, the mismatch may occur due to the works demanding more time and resources than expected or due to the quality falling short of *a priori* expectations. Double-loop learning occurs when the underlying assumptions or values are questioned by the organisation. The process of questioning assumptions or predefined values (*e.g.* as written in the project specifications) may take place because of conflict among, for instance, project participants or other project stakeholders. Triple-loop learning occurs when the ‘*why*’ questions are asked to examine the existing context, for example through a value engineering process. The process of questioning context may take place due to the demands for better quality or ‘value for money’. In order to better understand these processes, it may be useful to compare the unique characteristics of each mode of learning in terms of its outcomes and the process involved (see *Table 2.5*).

Table 2.5
Characteristics of single, double and triple loop learning (Argyris and Schön, 1978)

<i>Learning mode</i>	<i>Characteristics of learning</i>	
	<i>What it involves?</i>	<i>Intended outcomes</i>
Single loop learning	<ul style="list-style-type: none"> ▪ Apply existing rules/ procedures/ methods. ▪ Deal with symptoms of problems. ▪ Thinking ‘<i>inside the box</i>’. 	<ul style="list-style-type: none"> ▪ More efficient ways of working. ▪ Improved practices or application of rules/ procedures/ methods.
Double loop learning	<ul style="list-style-type: none"> ▪ Question assumptions and rules or procedures. ▪ Examine underlying causes of problems. ▪ Thinking ‘<i>outside the box</i>’. 	<ul style="list-style-type: none"> ▪ More effective ways of working. ▪ New knowledge and insights. ▪ Improved practices, rules and procedures. ▪ Improved systems and strategies.
Triple-loop learning	<ul style="list-style-type: none"> ▪ Examine core values and identity. ▪ Rethink fundamental purpose and principles. ▪ Thinking ‘<i>about the box</i>’. 	<ul style="list-style-type: none"> ▪ Renewed statement of core values and purpose. ▪ Renewed identity.

2.2.2 *Fiol and Lyles's Classification of Learning*

Fiol and Lyles (1985) identify two different levels of learning referred to as lower and higher level learning. Different characteristics of lower and higher level of learning are presented in *Table 2.6*.

Table 2.6
Different characteristics of lower and higher level learning (Fiol and Lyles, 1985)

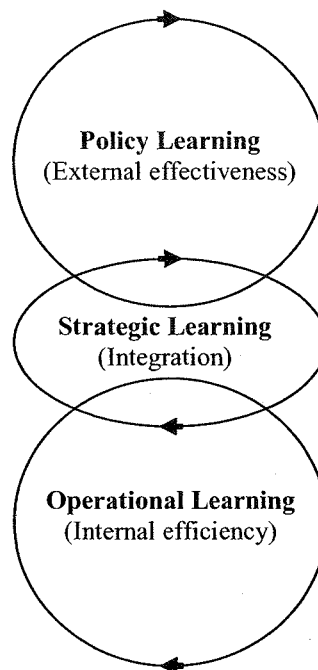
<i>Characteristics of organisational learning</i>	
<i>Lower level learning</i>	<i>Higher level learning</i>
1) Occurs within a given organisational structure or given set of rules.	1) Aims at adjusting overall rules and norms rather than specific activities and behaviours.
2) Leads to the development of some fundamental associations of behaviour and outcomes that are short in duration and impact only on part of what the organisation does.	2) Results in long-term effects and impacts on the organisation as a whole.
3) Is the result of repetition and routine and involves association building.	3) Is more of a cognitive process than lower level learning.
4) Tends to take place in organisational contexts that are well-understood and in which management thinks it can control situations.	4) Suggests that some type of crisis is necessary for changes in higher level learning – such as a new strategy, new leader, or a dramatically altered market.
5) Focuses learning on the immediate effect on a particular activity or facet of the organisation.	5) Focuses on higher level learning as particularly relevant to strategic management because it is level of learning that will impact a company's long survival.

Lower level learning is also described as adaptive learning by Senge (1990). Adaptive learning focuses on solving problems in the present without examining the appropriateness of current learning behaviours. An adaptive organisation focuses on incremental improvements, often based upon the past record of success. It is also about 'coping' in Peter Senge's term, whilst higher level learning is referred to as generative learning, which is about 'creating'. In Senge's (1990) view, generative learning requires systemic thinking, shared vision, personal mastery, team learning, and creative tension (between the vision and the current reality). Generative learning emphasises the continuous experimentation and feedback in an ongoing examination of the way in which an organisation goes about defining and solving problems.

2.2.3 Garratt's Classification of Learning

Garratt (2000) establishes three different levels of organisational learning: policy learning, operational learning, and strategic learning. In his view, central to an effective learning organisation is managing the balance between enduring internal organisation processes and taking feedback from its external world. Whilst the policy learning addresses the external world and the operational learning focuses on the internal operation, strategic learning is the central processor that regulates and balances the two. The inter-relationship between these three learning levels is represented in *Figure 2.6*. The underlying principle behind this model is thus the belief that an organisation can only become simultaneously effective and efficient if there is conscious and continuous learning between three distinct groups – the leaders who direct the enterprise, the staff who deliver the product or service, and the clients or customers who enjoy the product or service.

Figure 2.6
Garratt's (2000) model of organisational learning



Policy learning

In Garratt's (2000) definition, the organisation's relationship with the external world is the focus of 'organisational effectiveness'. Organisational performance and benchmarking should be measured by the perception of outsiders. Garratt (2000) argues that a satisfied customer is more likely to make repeat business and hence reduce the cost of marketing campaigns. A satisfied repeat client is also more likely to pay a small price premium, as they believe that the product or service is good value for money. Satisfied repeat customers are also more likely to recommend the product or service that they enjoyed to others. Thus, the effectiveness of feedback systems to capture user experiences is central to policy learning.

Operational Learning

Operational learning aims at achieving organisational efficiency – but not at the expense of organisational effectiveness. Garratt (2000) explains that “at its simplest level, operational learning is the continuous process of moving people towards conscious competence within their organisation”.

Strategic Learning

Strategic learning is the central processor of the organisation – the organisation's 'corporate brain' – bringing together, assessing and balancing information and ideas flowing from the external world of policy learning, and the internal world of operational learning. In more operational terms, Garratt (2000) describes strategic learning as monitoring the changing external world, reviewing the organisation's position in these changes, making risk assessments to protect and develop enterprise, broadly deploying its scarce resources to achieve its purpose, and ensuring that there are feedback procedures in place to measure the effectiveness of any strategy being implemented. The output from strategic learning allows the board of directors and senior executives to both drive the organisation forward and keep it under prudent control.

2.2.4 Learning Orientations

A growing body of literature suggests that a learning orientation is just as vital to superior performance of a company as market orientation (Slater and Narver, 1995; Sinkula and Baker, 1997; Hurley and Hult, 1998). Learning orientations are “the values and practices that reflect where learning takes place and the nature of what is learned” and “these orientations form a pattern that defines a given organisation’s learning style” (Nevis *et al.*, 1995: 76). Edwin Nevis, Anthony DiBella and Janet Gould through their published works in Nevis *et al.* (1995), DiBella *et al.* (1996), and DiBella (2001) identify seven learning orientations derived from their case studies. DiBella *et al.* (1996) explain that each of these orientations is conceived as a bi-polar continuum that reflects learning processes. *Table 2.7* below summarises the definitions and dimensions of learning orientations as proposed by Nevis, DiBella and Gould.

Table 2.7
Seven different Learning Orientations

<i>Learning Orientations</i>	<i>Definitions</i>	<i>Dimension</i>
1) Knowledge source	Preference for developing knowledge internally versus preference for acquiring knowledge developed externally.	Internal—External
2) Dissemination mode	Knowledge is shared in formal, institutionalised mechanisms versus knowledge that is shared through informal mechanisms.	Formal—Informal
3) Knowledge reserve	Knowledge is tacitly possessed by individuals versus knowledge that is codified and publicly available.	Personal—Public
4) Skill development focus	Development of knowledge and skills pertaining to individual performance versus development of knowledge and skills pertaining to collective performance.	Individual—Collective
5) Learning focus	Preference for knowledge related to the improvement of existing products, services, or capabilities versus preference for knowledge related to the development of new ones.	Incremental—Radical
6) Product-process focus	Emphasis on knowledge about what products or services are versus emphasis on knowledge about how those products or services are developed, delivered, or improved.	Content—Process
7) Value-chain focus	Emphasis on learning investments in engineering/production activities (‘design and make functions’) versus sales/service (‘market and deliver functions’).	Design-make—Market-deliver

The next sections that follow are dedicated to providing fuller accounts on the first three learning orientations highlighted in *Table 2.7*. These three learning orientations draw special treatments due to their closeness with the three-step process of organisational learning: knowledge acquisition, knowledge sharing and knowledge retention. Knowledge sourcing is conceptually similar to knowledge acquisition. The dissemination mode split is equal to knowledge sharing concept and the knowledge reserve model is similar to that of knowledge retention mechanisms.

2.2.5 Knowledge Acquisition: Internal vs. External

Kessler *et al.* (2000) contend that a company's success depends on how well it can enhance its own knowledge base by either creating new knowledge or obtaining existing knowledge from an outside source. This concurs with DiBella *et al.*'s (1996) knowledge source orientation discussed in the preceding section. According to Kessler and his colleagues, whether a company predominantly creates new knowledge, which they refer to as internal learning, or obtains existing knowledge from an outside source, which they refer to as external learning, has direct implications on how well it can integrate and apply its knowledge. They further reason that the external learning process differs from the internal learning process in that it faces a different set of organisational barriers and relies on different facilitators. Such a proposition has been tested in new product development projects drawn from ten large companies operating in a variety of industries (Advanced/Scientific Materials, Chemicals/Chemical Materials, Confectionary/Consumer Goods, and Industrial Equipment/Products). Their study indicates internal learning sourcing was generally more beneficial for the company, not only because it was associated with faster project completion times, but also because it was more likely to result in a greater competitive advantage. Internal learning companies are more likely to build 'isolating mechanisms' and develop significant 'first mover advantages'.

They also found that the effect of external learning sourcing on innovation speed and competitive advantage were contingent on the stage of development of the projects. External sourcing was more detrimental to competitive advantage during the idea generation stage, but outsourcing during the technology development stage significantly increased project completion time. In their conclusions, Kessler and his teams offer three useful pointers about the consequences of outsourcing versus the in-house

development of technologies: (1) companies should develop internally those technologies that will lead to a core competency and a competitive advantage and outsource activities that have less strategic importance for the companies; (2) the general advantages associated with internal sourcing necessitate that companies develop a climate and culture where internal learning and knowledge generation are encouraged, for example through developing a culture where risk taking is rewarded and by creating structural mechanisms where teamwork, empowerment and cross-functional communications are institutionalised; and (3) managers need to consider several key dependent variables when making the decision to outsource – speed , cost and overall effectiveness.

2.2.6 Knowledge Sharing: Formal vs. Informal

Knowledge sharing may take place through formal or informal settings. DiBella *et al.* (1996) contrast two different approaches to knowledge sharing: formal versus informal. The difference between the two is assumed in terms of the degree of organisational control over the knowledge sharing process. The formal approach uses more structured, planned and conditioned mechanisms. Informal knowledge sharing occurs in everyday casual interaction between organisation members. According to Hew and Hara (2006), informal, ‘just-in-time’ learning occurs in the context of immediate curiosity, needs or desires. They believe that a casual and the-need-to-know approach can transform individuals into active knowledge builders possessing substantial autonomy regarding the specific knowledge or skills required.

Recently, there has been a growing body of research that inquires into the nature of knowledge sharing as a function of social structure. This school argues that sharing knowledge, whether through formal or informal mechanisms, is a fundamental part of social life (Lave and Wenger, 1991). Knowledge sharing is considered social, not just because it involves coordinated action, but because it is a required process in any system where individuals interact.

Tsai (2002) proposes that coordinating different units to share their knowledge is critical to enhance an organisation’s capabilities. In his view, organisational capability is the extent to which knowledge among different parts of an organisation can be harnessed, shared and integrated. Such internal sharing of company-specific knowledge

is an important source of competitive advantage. The writer claims that because diverse knowledge is embedded in different units, the way the company coordinates different units significantly affects the pattern of intra-organisational knowledge sharing. He distinguishes two modes of organisational coordination for knowledge sharing: (1) formal structure and (2) informal structure.

Formal structure refers to those aspects of the organisation that are planned. Formalisation is an important aspect of structure. It is the formal decision-making framework by which decisions are made through formal establishment, such as formal reporting systems, responsibility relationships, policies and procedures. Formal organisation can be seen and represented in chart form that displays the formal organisational structure, job titles, lines of authority and relationships.

Informal structure, on the other hand, refers to all of the relationship patterns that are not explicitly designed and regulated. In most cases, they emerge spontaneously because of the complex interactions among the organisation's members. It is normally understood to be casual or social interactions among employees unrelated to the company's formal authority structure (Tsai, 2002; *c.f.* Scott, 2001).

Tsai's (2002) study reveals that both formal and informal coordination mechanisms influence the practice of knowledge sharing in the company. Three control variables are relevant to the process of knowledge sharing in his research: (1) unit size, (2) geographic proximity, and (3) strategic relatedness.

2.2.7 Knowledge Retention: Personalisation vs. Codification

Hansen *et al.* (1999) recognise two distinct strategies for managing knowledge and learning in the organisation. They distinguish between *personalisation* and *codification*. A company that follows a personalisation strategy relies on person-to-person contact to allow for sharing experiences and knowledge directly between the organisation's members. In such a company, knowledge is closely tied to the person who developed it. On the other hand, a company that uses a codification strategy relies on the 'economies of reuse' because the reuse of knowledge saves work and time, reduces communications costs and allows a company to undertake more projects. In such a company, knowledge is carefully codified and stored in databases, where it can be accessed and used easily by

anyone in the company. Hansen *et al.* (1999) state that a company's choice of strategy is far from arbitrary – it depends on the way the company serves its clients, the economics of its business, and the people it hires. Emphasising the wrong strategy or trying to pursue both at the same time can, as some consulting firms have found, quickly undermine the business.

The personalisation approach considers that knowledge is personal in nature and very difficult to extract from people (see *Table 2.8*). Knowledge sharing is best implemented by moving people within or between projects and organisations. On the other hand, the codification approach assumes that knowledge can be articulated and codified to create organisational knowledge assets. Knowledge dissemination is best managed by using information technologies in the form of documents, drawings, best practice models, *etc.*

Table 2.8
Basic assumptions in personalisation versus codification
(Adapted from Sanchez, 2005)

<i>Personalisation approach</i>	<i>Codification approach</i>
<i>Knowledge is personal in nature and very difficult to extract from people.</i>	<i>Knowledge can be articulated and codified to create organisational knowledge assets.</i>
<i>Knowledge must be transferred by moving people within or between organisations</i>	<i>Knowledge can be disseminated (using information technologies) in the form of documents, drawings, best practice models, etc.</i>
<i>Learning can only be encouraged by bringing the right people together under the right circumstances.</i>	<i>Learning processes can be designed to remedy knowledge deficiencies through structured, managed, scientific processes.</i>

2.3 Characteristics of Learning Organisations

There are a number of scholars who have contributed in identifying the common characteristics of learning organisations (e.g. Goh, 1998; Senge, 1990; Rowden, 2001; Pedler *et al.*, 1997; Watkins and Marsick, 1993; Garvin, 1993; Marquardt, 1996). Numerous different models appear in the body of literature. Presented in this section are six different approaches by which theorists have established the characteristics or constructs of learning companies.

2.3.1 *People-focused Approach*

Hill (1996b: 19) states: “people are the life-blood of any organisation”. The people-focused approach believes that an organisation learns only through individuals who learn (Worrell, 1995: 352). A learning organisation, according to Peter Senge (1990), who has popularised the concept through his seminal book *The Fifth Discipline*, is “a place where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together” (Senge, 1990: 1). His learning company model consists of five disciplines: (1) personal mastery – support to individuals to understand their own capacities and dreams, (2) mental models – deep personal beliefs that shape how an organisation’s members approach their work and its relationship to society, (3) shared vision – the ability to build a shared picture of a mutually desirable future, (4) team learning – emphasis on creation of opportunities for individuals to work and learn together in a community, and (5) systems thinking – the ability to see interrelationships rather than linear cause and effect; a conceptual framework providing connections between units and members. These five disciplines are all interrelated. The four components – personal mastery, mental models, shared vision, and team learning – are the foundations of the organisation, and systems thinking is the cement that holds them all together.

2.3.2 *Strategic-focused Approach*

Proponents of the strategic-focused approach believe that the development of preconditions for an effective learning capability is the cornerstone of a learning company (Goh, 1998: 16). For Shaw and Perkins (1991), this means the need for

managers in an organisation to take strategic action and make specific interventions to ensure that learning can occur. Synthesised from the description of management practices and policies alluded to in the literature about learning companies, Goh (1998) proposed a set of strategic building blocks that characterise a learning organisation: (1) clarity and support for mission and vision, (2) supportive and committed leadership, (3) culture that encourages experimentation, (4) the ability to transfer knowledge across organisational boundaries, and (5) emphasis on teamwork and cooperation. In addition, the strategic building blocks require two supporting foundations: effective organisation design and appropriate employee skills and competencies. Thus the strategic perspective addresses three dimensions that make up a learning organisation, *i.e.* structure, people and strategy.

A second model that builds upon the strategic approach has been proposed by Robert Rowden. He defines a learning organisation as “one in which everyone is engaged in identifying and solving problems, enabling the organisation to continuously experiment, change, and improve, thus increasing its capacity to grow, learn, and achieve its purpose” (Rowden, 2001: 15). For him, becoming a learning organisation means increasing the size of the company’s brain. Learning is not something that just happens. It is made to happen. He further identifies four defining characteristics of a learning organisation: (1) constant readiness – the organisation exists in a constant readiness for change, attuned to its environment and willing to question its fundamental ways of doing business; (2) continuous planning – the organisation continuously re-evaluates and revises its plan; (3) improvised implementation – the organisation engages in flexible implementation of plans and encourages experimentation; and (4) action learning – the organisation provides frequent, ongoing opportunities for such action-based learning.

2.3.3 Tool or Technology-focused

The tool and technology focused paradigm tackles the content aspect of learning, *i.e.* ‘knowledge’. According to this view, the organisation is described as an information processing system (Simon, 1976) or learning system (Nevis *et al.*, 1995). A learning system has formal mechanisms that maintain and institutionalise learning (Shrivastava, 1983). For an organisation to be considered as learning, it must be acquiring, interpreting, distributing and storing information (Huber, 1991). Working from this

view, Garvin (1993: 80) posits that a “learning organisation is an organisation skilled at creating, acquiring and transferring knowledge, and modifying its behaviour to reflect new knowledge and insights”. He puts forward a system of five building blocks that consist of five main activities in which a learning organisation should be skilled: (1) systematic problem solving – this provides tools, systems and programmes for building a problem solving culture, *e.g.* TQM; (2) experimentation with new approaches – involves the systematic searching for and testing of new knowledge, *e.g.* ongoing programmes, demonstration projects; (3) learning from their own experience and past history – this refers to the system that ensures the mechanisms for reviewing and recording the company’s successes and failures are in place; (4) learning from the experiences and best practices of others – *e.g.* benchmarking; (5) transferring knowledge quickly and efficiently throughout the organisation – this provides systems and tools for knowledge transfer, *e.g.* IT, reports and tours.

The learning organisation has also been portrayed as the “knowledge creating company” which “consistently creates new knowledge, disseminates it widely throughout the organisation, and quickly embodies it in new technologies and products” (Nonaka, 1991: 96). According to Nonaka and Takeuchi (1995: 199) a knowledge-creating company possesses eleven distinct features that can be used to distinguish it from other companies. These characteristics are: (1) group based; (2) tacit knowledge-oriented; (3) strong on socialisation and internalisation; (4) emphasis on experience; (5) awareness of the dangers of ‘group think’ and ‘over adaptation to the past success’; (6) ambiguous organisational intention; (7) group autonomy; (8) creative chaos through overlapping tasks; (9) frequent fluctuation from top management; (10) redundancy of information; (11) requisite variety through cross-functional teams.

2.3.4 Context Development-focused

Theorists who focus their attention on the context development of learning in organisations define the learning organisation as “an organisation that facilitates the learning of all of its members and continuously transforms itself in order to meet its strategic goals” (Pedler *et al.*, 1997: 3). In a parallel tone, Worrell (1995: 352) describes it as “an organisational culture in which individual development is a priority, outmoded and erroneous ways of thinking are actively identified and corrected, and the purpose and vision of the organisation are clearly understood and supported by all its members”.

Believing that “a learning company is a vision of what may be possible”, Pedler *et al.*, (1997) developed their own learning organisation model. It consists of eleven dimensions: (1) learning approach to strategy – requires that the various aspects of policy and strategy formation are structured as a learning process; (2) participative policy making – ensures that all members have a chance to contribute to major policy decisions; (3) informing – assumes that new ways will be found by using information technology; (4) formative accounting and control – ensures that accounting and budgeting systems meet the information needs of all internal clients so as to strengthen the ethos of self-responsibility fostering semi-autonomous individuals and groups; (5) internal exchange – implies that all departments and units relate to each other as potential customers and suppliers; (6) reward flexibility – provides alternative ways of rewarding people apart from financial rewards; (7) enabling structures – takes a temporary form of structure that, whilst catering for current needs, can be shaped through experimentation to respond to future changes; (8) boundary workers as environmental scanners – all workers will collect information from their external environment; (9) inter-company learning – carries the learning ethos to external organisations; (10) learning climate – facilitates individual learning through tolerance of experiments and mistakes; (11) self-development for all – resources and facilities are available to allow all to take advantage of the enabling climate.

2.3.5 Systemic or Holistic Approach

For the systemic perspective, the idea is to think in terms of the “big picture” or to take the “helicopter view” (Garratt, 2000: xiii). General systems theory (see Von Bertalanffy, 1968) presents the organisation as a complex set of interdependent parts that interact with each other to adapt to a constantly changing environment both for survival and for fulfilling its goals. The systemic approach to the learning organisation therefore absorbs the following key points of general systems theory: interdependence, interaction between different components, adaptation, environment and goal.

Embracing the idea of a systemic or holistic approach, Watkins and Marsick (1993: 298) define a learning organisation as “one in which learning is a continuous, strategically used process – integrated with and running parallel to work – that may yield to changes in individual and collectively held perceptions, thinking, behaviours, attitudes, values, beliefs, mental models, systems, strategies, policies and procedures”.

In their model, Watkins and Marsick (1993) identify seven distinct but interrelated dimensions of a learning organisation at individual, team and organisational levels, and even at the level of the community with which the organisation interacts. These dimensions are: (1) continuous learning – represents an organisation's effort to create continuous learning opportunities for all of its members; (2) inquiry and dialogue – refers to an organisation's effort in creating a culture of questioning, feedback and experimentation; (3) team learning – reflects the spirit of collaboration and the collaborative skills that underpin the effective use of teams; (4) empowerment – signifies an organisation's process to create and share a collective vision and get feedback from its members about the gap between the current status and the new vision; (5) embedded system – indicates efforts to establish systems to capture and share learning; (6) system connection – reflects global thinking and actions to connect the organisation to its internal and external environment; (7) strategic leadership – shows the extent to which leaders think strategically about how to use learning to create change and to move the organisation in new directions or into new markets.

A second theorist who has contributed by building a learning organisation model from the systemic approach is Marquardt (1996). In his book *Building the Learning Organisation*, he identifies dimensions and characteristics of a learning organisation. These are as follows: (1) learning is accomplished by the organisational system as a whole, almost as if the organisation were a single brain; (2) organisation members recognise the critical importance of ongoing organisation-wide learning for the organisation's current as well as future success; (3) learning is a continuous and integrated process that runs parallel to work; (4) there is a focus on creativity and generative learning; (5) system thinking is fundamental; (6) people have continuous access to information and data resources that are important to the company; (7) a corporate climate exists that encourages, rewards and accelerates individual and group learning; (8) workers network in an innovative, community-like manner inside and outside the organisation; (9) change is embraced, and expected-surprises and even failures are viewed as opportunities to learn; (10) it is an agile and flexible organisation; (11) everyone is driven by a desire for quality and continuous improvement; (12) activities are characterised by aspiration, reflection and conceptualisation; (13) there are well-developed core competences that serve as the taking-off points for new products and services; (14) it possesses the ability to continuously adapt, renew, and revitalise

itself in response to the changing environment. In summary, Marquardt's (1996) learning organisation model has five components: learning, knowledge, organisation, technology and people.

Another learning organisation system is proposed by Redding (1997). Promoting his systemic view, Redding (1997: 64) argues that "a company should be viewed as a whole system, in which all areas have complex, inter-related effects on each other". For the purpose of development of his proposed learning organisation assessment instrument, he further formulated an organisation system that consists of (1) vision and strategy – large-group interventions and scenario planning; (2) leadership and management – through action learning and leadership roles in modelling learning; (3) culture – alignment of culture to organisational learning; (4) structure – self-organising structures; (5) communication, information systems and knowledge systems – the use of knowledge management and transfer systems; (6) performance management – linking performance measurements and rewards to learning; (7) technology – using technology to facilitate learning.

Whilst focusing on people, Senge's (1990) model is also complementary with the idea of a systemic approach. His fifth discipline of a learning organisation, *i.e.* systems thinking, confirms an understanding that organisational endeavours are one system or whole, made up of an invisible fabric of interrelated actions, which often take years to fully play out their effects on each other (Worrell, 1995).

2.3.6 *An Attempt at Synthesis*

Fred Luthans (1995) attempted to synthesise the learning organisation models of the two literature bases – practitioner oriented and academic journals. He summarises three common characteristics of learning organisations present in the literature: (1) presence of tension – tension and conflict can initiate learning, which will be evidenced by questioning, inquiry, disequilibrium and a challenging of the status quo; (2) presence of systems thinking – this implies the idea of a holistic view or 'thinking big'; (3) a culture which facilitates learning – a culture that is conducive to individual and group learning.

Luthans (1995) goes further, proposing techniques and strategies to help an organisation to develop and transform into a learning organisation. These include: (1) learning

laboratories/management micro-worlds – espouses the idea of learning from an isolated, compressed time and space, *e.g.* a flight simulator for pilots; (2) scenario planning – embraces the idea of DeGeus (1988) of ‘planning as learning’, a technique which helps break previously held assumptions and allows managers to learn; (3) experimentation – adopts the notion of learning by doing; (4) learning from the past – advances the benefit of capturing the lessons from successes and failures; (5) learning from others – captures lessons from others through benchmarking, imitation, *etc.*; (6) systematic problem solving – refers to the need to see interrelationships in solving problems; and (7) active learning – learning should become everybody’s intention.

Nyhan *et al.* (2004) criticise the concept of the learning organisation as “a problematic concept and, indeed, a contested one” (p.69). They then propose eight key principles that they believe can help to balance the various competing dimensions. Their aim is to synthesise the dualism of meanings of a learning organisation that have long been debated in the literature, *i.e.* whether it entails ‘process’ or ‘goal’. However, they contend that particular emphasis should be placed on the organisational learning process as a continuing transformation process. Thus, the learning organisation concept should be understood as marrying a continual organisational learning process in ‘becoming’ a learning organisation and the ‘state of being’ of a learning organisation – existentialist and not static.

The eight key principles of Nyhan *et al.* (2004) are: (1) avoiding dualism and the quick-fix; (2) seeing conflict as providing opportunities for learning; (3) transforming industrial relations into learning relations; (4) developmental work and learning – prerequisites for organisational learning; (5) importance of a supportive learning environment; (6) informal learning; (7) who leads the learning organisation – emphasis on self-organised learning; and (8) balancing the needs of the company with wider societal needs.

Phillips (2004) has tried to synthesise the characteristics of a learning organisation from various models. He reaches the conclusions that an ideal learning organisation should possess: (1) will; (2) leadership; (3) strategic thinking and vision; (4) free and open communication; (5) continuous learning and development; (6) innovation and decision making; (7) change management; (8) intellectual capital and knowledge management; (9) measurement and assessment; and (10) reward and recognition.

2.4 Organisational Learning and Knowledge

Organisations are seen as learning through a number of processes that create new knowledge or modify existing knowledge (Levitt and March, 1988; Miller, 1996; Garvin, 1993). These processes in particular have established wide interest in the knowledge creation and development paradigms where organisations learn by creating, acquiring and transferring knowledge and understanding which guide their behaviour (Garvin, 1993). Tsang (1997) uses knowledge management synonymously with organisational learning. These two different disciplines are intertwined as the growing literature shows. This concept is supported by Weick (1991) who discusses the organisational learning phenomena under two essentially distinct conceptualisations. First, it focuses on behaviour where organisational learning is related to change in behavioural responses. Second, it focuses on the information processing system of an organisation, where learning is seen as the process of disseminating information across different levels in an organisation.

Most studies on organisational learning are concerned with the acquisition of knowledge, and to a lesser extent with the sharing or assimilating process of acquired knowledge (Garvin, 1993; Miller, 1996; Shrivastava, 1983). Bierley *et al.* (2000) refer to organisational learning as changes to organisational knowledge that is induced by information processing and that enable organisations to find new ways in order to survive and succeed in new situations. These authors conceptualise organisational learning as a communication process, that changes organisationally shared mental models. By learning, individuals can overcome previous boundaries of knowledge or ability and learn how to cope with a variety of situations. Liebowitz and Megbolugbe (2003) observe that with the creation and capture of knowledge, learning takes place and knowledge is applied and embedded within individual and organisational processes. Organisations may learn effectively from the experiences and utilise them efficiently.

2.4.1 Understanding Knowledge: Tacit versus Explicit

As highlighted above, it seems that knowledge cannot sit apart from learning. In fact, most knowledge results from learning. Sveiby (2001) defines knowledge as the capacity to act. Knowledge is a result of learning where data and information are transformed and utilised by individuals. McDermott (1999) claims that: (1) knowing is an individual

act, (2) knowledge is the residue of thinking, (3) knowledge is created in the present moment, (4) knowledge belongs to communities, and (5) new knowledge is created at the boundaries of the old knowledge.

Michael Polanyi (1962) makes a clear distinction between two kinds of knowledge: implicit or tacit knowledge and explicit knowledge. Tacit knowledge is embedded in personal experiences and involves subjective insights, perspectives, intuitions, hunches and beliefs, whereas explicit knowledge can easily be expressed and communicated to others in words and numbers, mathematical expressions and scientific formulae.

Polanyi (1962) defines tacit knowledge as the knowledge that is non-verbalisable, intuitive and unarticulated. Explicit knowledge is codified and transferable in formal, systematic methods, such as in rules and procedures (Nonaka and Takeuchi, 1995). Individual explicit knowledge consists of knowledge and skills that can be easily taught or written down, whereas collective explicit knowledge resides in standard operating procedures, documentation, information systems and rules (Brown and Duguid, 1991). *Table 2.9* provides an overview of some characteristics associated with tacit and explicit knowledge.

Table 2.9
The characteristics of tacit and explicit knowledge
(Source: Polanyi, 1962; Nonaka and Takeuchi, 1995; and Baumard, 1999)

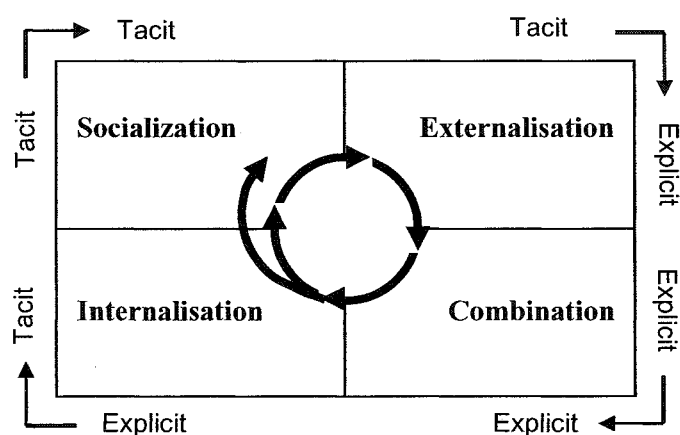
<i>Tacit knowledge</i>	<i>Explicit knowledge</i>
<ul style="list-style-type: none"> ▪ Subjective and intuitive ▪ Personally bound ▪ Held within self ▪ Hard to articulate and communicate ▪ Difficult to formalise ▪ Embedded in stories and narratives ▪ In the forms of rules and methods ▪ Functional and systematic knowledge ▪ May be transferred through conversation 	<ul style="list-style-type: none"> ▪ Objective ▪ Not bound to an individual ▪ Shared with others ▪ Can be articulated and stored ▪ Codifiable ▪ Stored in repositories (databases, files) ▪ In the forms of skills and habits ▪ Values and judgments ▪ Documented (written, taped, etc.)

The knowledge creation view considers that new knowledge can be created through dynamic interactions between explicit and tacit knowledge (Nonaka, 1991; Nonaka and Takeuchi, 1995). Stressing the importance of knowledge to an organisation, Nonaka (1991) states that successful companies are those that consistently (1) create new knowledge, (2) disseminate it widely throughout the organisation, and (3) embody it quickly in new technologies and products.

2.4.2 Knowledge Creation Model

Based on the distinction between these two forms of knowledge – tacit versus explicit – Nonaka and Takeuchi (1995: 71–72) propose four sequential patterns that constitute knowledge creation: (1) tacit-to-tacit, where existing tacit knowledge is converted into new tacit knowledge through the process of *socialisation*; (2) tacit-to-explicit, where tacit knowledge is transformed into explicit knowledge through the process of *externalisation*; (3) explicit-to-explicit, where existing explicit knowledge is re-shaped into new explicit knowledge through the process of *combination*, and (4) explicit-to-tacit, where explicit knowledge is transformed into tacit knowledge through the process of *internalisation*. Following the last stage of this cycle, the process continues at a new level; hence the metaphor of a spiral knowledge creation (see Figure 2.7).

Figure 2.7
Nonaka and Takeuchi's (1995) model of knowledge creation



Nonaka and Takeuchi (1995) provide some practical instances in real live company operations in order to better explain this knowledge creation model.

- (1) *Socialisation (tacit-to-tacit)* – Acquiring someone else’s tacit knowledge through observation, imitation and practice. Nonaka and Takeuchi (1995) use an example from a product development staff member who apprentices herself to a hotel chef famous for the quality of his bread. She learns how to make bread his way, including an unusual kneading technique.
- (2) *Externalisation (tacit-to-explicit)* – Externalisation of tacitly held knowledge through the use of appropriate metaphors and other triggering devices. Here, Nonaka and Takeuchi (1995) cite the product development staff member’s subsequent conversion of her acquired tacit knowledge into specifications for a bread-making machine.
- (3) *Combination (explicit-to-explicit)* – Reconfiguring existing knowledge or combining discrete pieces of explicit knowledge to form new explicit knowledge, for example, compiling data and preparing a report that analyses and synthesises these data. The report constitutes new explicit knowledge.
- (4) *Internalisation (explicit-to-tacit)* – Internalising explicit knowledge. Here, Nonaka and Takeuchi (1995) describe that as the product development team acquiring new tacit knowledge, specifically, they came to understand in an intuitive way that products like the home bread-making machine can provide quality; that is, they can produce bread as good as that made by a professional baker.

As a result of the knowledge creation process discussed above, four classifications of knowledge emerged (see Rajan *et al.*, 1999: 2):

- (1) *intuitive knowledge*, which involves spreading individual insights and intuition from some to many people inside a company.
- (2) *conceptual knowledge*, which involves translating individual insights into words or concepts that can be disseminated widely through oral, written or visual means.

- (3) *operational knowledge*, which involves internalising a formal body of knowledge into an individual's subconscious by its repeated application.
- (4) *systematic knowledge*, which involves creating a library of knowledge using words, concepts and numbers in ways that provide easy access to all.

2.4.3 *Corporate Memory*

As Rajan *et al.* (1999) write “all forms of knowledge are important”, but retaining them in corporate memories for future use is of equal importance. For Huber (1991), organisational memory is the final process of his organisational learning cycle. Examples of corporate memory as they appear in the literature are standard operating procedures (March and Simon, 1993) or routines (Miner, 1991), individual repositories, recorded documents and computer-based information (Huber, 1991), organisational systems, structures, cultures and artefacts (Hedberg, 1981).

Finnie (1997) defines corporate memory as part of a learning system that retains what has been learned in the past and provides access to that learning in the future. Kim (1993: 43) adds that it “includes everything that is contained in an organisation that is somehow retrievable”. Corporate memories certainly contain not only codified (explicit) knowledge but also implicit knowledge to include concrete experiences or a set of abstracts conceptualisation (Stein, 1995). Concrete experiences may be contained in stories, feelings, opinions and what has been observed, whilst abstract concepts may take the forms of (1) science – containing laws, theorems, and procedures accepted as valid knowledge – or (2) judgment – containing workable knowledge in the forms of policy, rules, probabilities and heuristics. Science is public and accepted knowledge, whereas judgment is uncertain, often private and untested knowledge (Wijnhoven, 1998: 31).

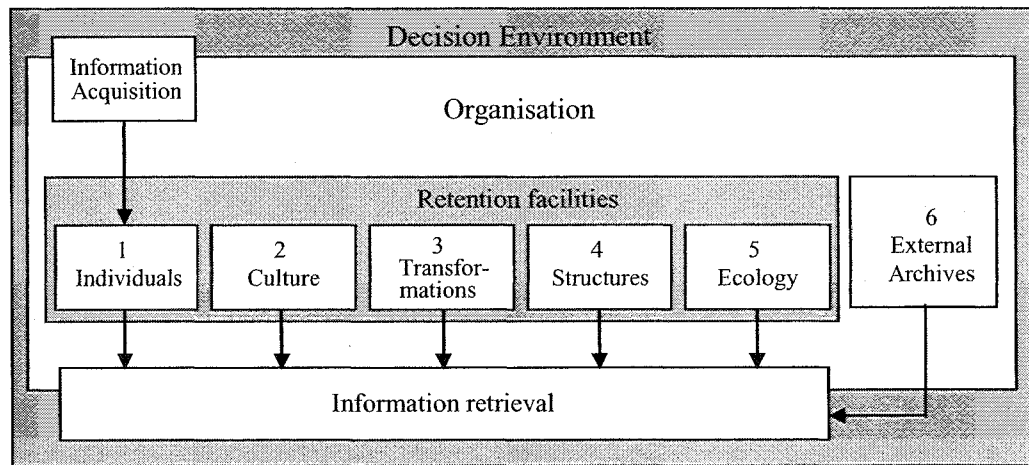
Stein (1995) conducted a search on works that contributed to the development of corporate memory research. Reproduced in *Table 2.10*, Stein (1995: 20-21) compiled some selected works that define corporate memory.

Table 2.10
Definitions of corporate memory and its means of retention
(Adapted from Stein, 1995)

<i>Authors</i>	<i>Definition of corporate memory</i>	<i>Means of retention</i>
Cyert and March (1963)	Memory as contained in procedures.	People and files; standard operating procedures.
Krippendorff (1975)	Memory as: (1) communication process; (2) organisational structure; (3) by-product of encoding/ decoding.	People (behaviours, stories); organisational structures; records (files; databases, <i>etc.</i>).
Argyris and Schon (1978)	Memory as a consequence of learning. Memory required to store learning, but memory may be obstacle to change.	People (cognitive maps); culture (norms, shared understandings) maps.
Miller (1978)	Memory as second stage of learning process.	People (roles); artefacts (files, databases; photographs, recordings.
Morgan and Root (1979)	Memory as means to increase information exchange.	People (personal knowledge); files; procedures and policies; databases; expert systems .
Weick (1979)	Memory co-produces personality of the firm based on people's interpretations of their environments.	People (maps); rules; files and computers.
Nelson and Winter (1982)	Memory as routine behaviours	People (routine patterns of behaviours)
Smith (1982)	Memory as collective experience	People (behaviour); language; myths; symbols; rituals.
Stein (1992)	Framework and empirical study of organisational memory	Scheme; scripts; systems.

As clearly reflected in *Table 2.10*, the knowledge of organisation is thought to be stored in various physical locations. Using the storage metaphor from individual-level memory processes, Walsh and Ungson (1991) posit the existence of five storage bins or retention facilities that compose the structure of memory within an organisation and one source outside of the organisation (see *Figure 2.8*).

Figure 2.8
The structure of corporate memory
(Adapted from Walsh and Ungson, 1991)



Discussing the above model, Walsh and Ungson (1991) argue that the patterns of knowledge retention may vary according to how well a particular piece of knowledge can be stored. They also describe that organisational memory is not stored in one location, but rather it may be distributed across different parts of an organisation. Wijnhoven (1998) introduces *systems* – that is computer-based information systems – as a primary retention medium in addition to the other five media proposed by Walsh and Ungson (1991). *Table 2.11* provides an overview of possible contents that can be memorised by different medium.

Table 2.11
Retention media and memory contents

<i>Medium</i>	<i>Memory contents</i>
Individuals	Professional skills; personal ethics; beliefs, individual routines, know-how.
Culture	Schemes, stories, cultural routines, norms, tradition, language.
Structure	Task decisions, hierarchy, social structure, formal structure, communication structure, responsibilities and authority structure.
Ecology	Layout of shop floor, building architecture.
External	Client and market characteristics, completion profiles, list of knowledgeable people and organisations, technology of competitors.
Systems	Planning and decision systems, process control systems, Groupware, computer aided design systems, knowledge-based systems, and administrative system.

2.5 Organisational Learning Systems

Nevis *et al.* (1995) state, “all organisations are learning systems”. In their studies of different organisations, Nevis and his colleagues found that these organisations function as learning systems in that they have formal and informal processes and structures for acquisition, sharing and utilisation of knowledge and skills. These authors report that organisation members in all companies communicated broadly and assimilated values, norms, procedures and outcome data, starting with early socialisations and continuing through group communications, both formal and informal. Nevis observed that even companies that claimed that they were not good learning organisations had certain core competencies that could exist only due to certain learning mechanisms being in place. These competencies would have never existed without learning investments in those particular areas. Some type of structure or process would have to support the informed experience and formal mechanisms required for organisational learning. For example, as these authors describe, one company that considered itself to be a poor learning organisation because of its difficulty in changing some dysfunction had a reputation in its industry for superior field marketing. This suggests that some learning must have been assimilated at a fairly deep level in this respected field.

Nevis *et al.* (1995) argue that companies do not usually regard learning as a function of production. However, in their research on successful companies the authors are able to identify three learning-related factors that are important for their success:

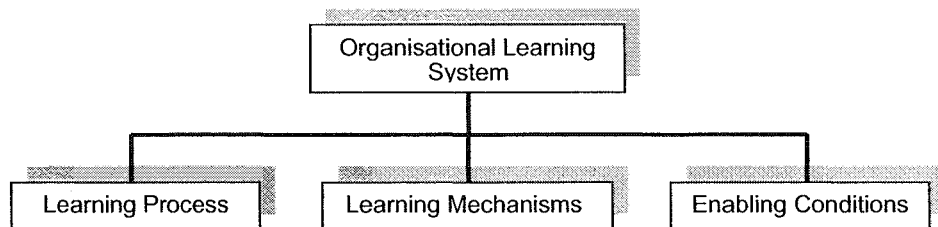
- (1) Well-developed core competencies that serve as launch points for new products and services.
- (2) An attitude that supports continuous improvement in the business’s value-added chain.
- (3) The ability to fundamentally renew or revitalise.

The authors associate these factors with the qualities of an effective learning organisation that diligently pursues a constantly enhanced knowledge base. This knowledge allows for the development of competencies and incremental or transformational change. For example, Canon has made significant investments over time in developing knowledge in eight core competencies applied in the creation of

more than thirty products; Wal-Mart conducts ongoing experiments in its stores; and Motorola has a long history of renewing itself through its products by periodically exiting old lines and entering new ones. Based on these examples, Nevis *et al.* (1995) presume the existence of process for assimilation and utilisation of knowledge and some kind of integrated learning system to support such 'actionable learning' in the companies. In fact, an organisation's ability to survive and grow is based on advantages that stem from core competencies that represent collective learning.

Understanding organisations as learning systems provides a basis for analysing organisational learning in the realities of practice rather than merely idealistic theoretical models. Organisational learning systems are systems that have formal and informal mechanisms for knowledge acquisition, knowledge sharing and retention (Shrivastava, 1983; Nevis *et al.*, 1995). They process learning developed internally as well as externally, and attempt to either retain their good staff or to objectify the subjective personal knowledge of individual members into an organisational knowledge base. Organisational learning systems consist of three key units of analysis: learning process, learning mechanisms and enabling conditions (*Figure 2.9*).

Figure 2.9
Elements of organisational learning system



2.5.1 Organisational Learning as a Process

Cyert and March (1963) were probably the first to develop the process school of organisational learning. The process school emphasise that organisational learning is a process that involves information distribution through interactions amongst organisational members (Huber, 1991). The process view also presumes that learning is a socially constructed phenomenon meaning that learning is determined by the degree of social interaction amongst organisational members at different levels. Social interaction describes different ways members interact and it is these interactions that facilitate the

performance of the organisational learning process, and in turn determines the style and nature of learning between members. The process school is dominated by technical and social perspectives (Easterby-Smith, 1997). The technical perspective analyses organisational learning as the effective processing of information and the social perspective considers learning as something that can emerge from social interactions, normally in the natural work setting (Easterby-Smith and Araujo, 1999).

2.5.2 Organisational Learning Mechanisms

Popper and Lipshitz (2000) define organisational learning mechanisms as institutionalised structural and procedural arrangements that allow organisations to learn non-vicariously, that is, to collect, analyse, store, disseminate and use systematically information that is relevant to the organisations and their members' performance. According to these authors, the learning mechanisms function as venues for individual learning and link this learning to become organisational. The authors classified learning mechanisms as *integrated* or *non-integrated* and *designated* or *dual-purpose* mechanisms, depending on 'when' and 'by whom' they are operated. An organisational learning mechanism is integrated if its 'producers' and 'users' (*i.e.* organisational members who are responsible for generating and applying its lessons learned, respectively) are identical. For example, consider a project manager who produces personal cases about his/her project experience for personal use. A learning mechanism is non-integrated if its producers and users are not identical. For example, a project team that prepares project reports for the management. A designated learning mechanism is the one in which learning takes place away from task performance, for example in the forms of post project reviews. In dual-purpose mechanisms, learning is carried out in conjunction with task performance, for example in the forms of quality circles and communities of practice.

2.5.3 Enabling Conditions

Von Krogh *et al.* (2000) point out that effective learning depends on an enabling context. What they mean by enabling context is a shared space that fosters emerging relationships. Angle (1989) found that innovation, but also learning, occurs in organisations that provide a context that both motivates and enables employees to engage in innovative behaviour. This necessarily implies that organisations should

create a climate that is conducive for employees to engage in various learning activities that are embedded in their formal work tasks and informal communities of practice.

Teare (1997) provides some propositions that are useful to consider in enabling organisational learning to occur as effectively as possible, as an outcome of both formal programmed learning and informal self-reflection:

- The organisation should equip itself with mechanisms to detect and respond appropriately to market trends.
- The organisation should provide a context that can encourage its members to think and act responsively and without unnecessary constraints so that natural curiosity and inquiry drives learning.
- The organisation should provide a context that can facilitate self-organised learning networks.
- The organisation may consider the use of communications technologies to create a searchable knowledge network within the organisation to support learning effort.
- There should be a mechanism in place to ensure that learning from experience is captured and that opportunities for organisational learning from self-reflection and from studying other organisations are acted upon.
- The organisation may consider engaging in a learning partnership with external catalysts such as through joint research and benchmarking activities.
- Employee-related performance measures should be given emphasis and be related to improvements arising from the organisational learning effort.

Adler and Borys (1996) associate enabling contexts with organisational structure. The authors define enabling organisational structure as rules and procedures that are developed to mobilise employees' intelligence. Rules and procedures are developed based on best practices arising from employees' experience. They are flexible enough to allow employees to respond to unforeseen contingencies that arise in their work, actions which allow future learning and best practice development. Implicit in the Adler and Borys (1996) argument is the idea that it can be stipulated so that the enabling context could lead employees to exert learning efforts under constructive organisational directions.

Other researchers relate enabling context to learning climate. Climate is understood to be a set of individual perceptions of the organisational context, descriptions that represent interpretations of salient organisational features, events and processes (Mikkelsen *et al.*, 1998).

Watkins and Marsick (1993) and Marquardt (1996) and others see a culture that supports the acquisition of knowledge, the distribution and sharing of learning, and provides rewards and recognition for learning and its application as critical for successful learning organisations. Kotter and Heskett (1992) identify an adaptive, learning culture – or a culture that fosters and nurtures learning and innovation – as the optimal culture for organisations pursuing long-term performance in dynamic environments. However, according to Bates and Khasawneh (2005), culture and climate are related concepts and are believed by some to be most useful in understanding organisational phenomena when used in conjunction with one another. They argue that organisational learning cultures are those that support the acquisition of information, the distribution and sharing of learning, and that reinforce and support continuous learning and its application to organisational improvement. These authors further speculate that organisational learning cultures emphasise the open exchange of information and ideas in ways that facilitate learning and its creative application. Organisational learning culture can therefore be seen as a critical facilitator of creativity and innovation because it supports inquiry, risk-taking and experimentation.

Hedberg (1981) perceives that certain features facilitate organisational learning, for example by promoting experimentation, encouraging awareness in the organisation, redesigning and improving inner environments, reward and punishment systems and achieving dynamic balances through diversity and heterogeneity. In short, these are all examples of enabling conditions for organisational learning.

Being the core of the model, a set of complete conditions that supports organisational learning will be covered in detail in the later sections dedicated specifically to this topic. The following sections elaborate on organisational learning processes including the presentation of some selected models, followed by sections on evaluating learning mechanisms.

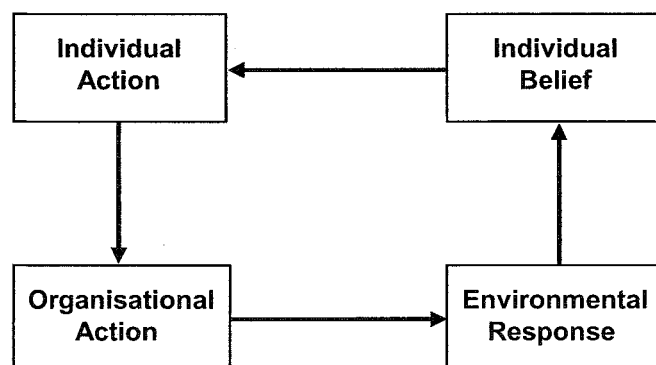
2.6 Organisational Learning Process

A large proportion of organisational learning studies seem to take the process approach, or they at least assume that organisational learning, analogously to individual learning, occurs as a process. From this point of view, learning has been defined as “a process by which individuals gain new knowledge and insights and thereby modify their behaviour and actions” (Stata, 1996) or “a process in which members of an organisation detect error or anomaly and correct it” (Argyris and Schön, 1978). A linguistic study by Sun (2003) verifies that the term ‘organisational learning’ in itself necessitates the processual meaning. Regarding the Miller’s (1996) definition of organisational learning as “the acquisition of new knowledge by actors who are able and willing to apply that knowledge in making decisions or influencing others in the organisation”, Sun (2003: 159) writes convincingly: “as a matter of fact, *the acquisition of new knowledge* is also a process”.

2.6.1 March and Olsen’s Model

A widely-shared view among theorists is to perceive the organisational process as a cycle. According to March and Olsen (1975), the organisational learning process begins with individual actions, which are based on certain individual beliefs. These actions, in turn, lead to organisational action, which produces some environmental response. The cycle is completed when the environmental response affects individual beliefs (see *Figure 2.10*).

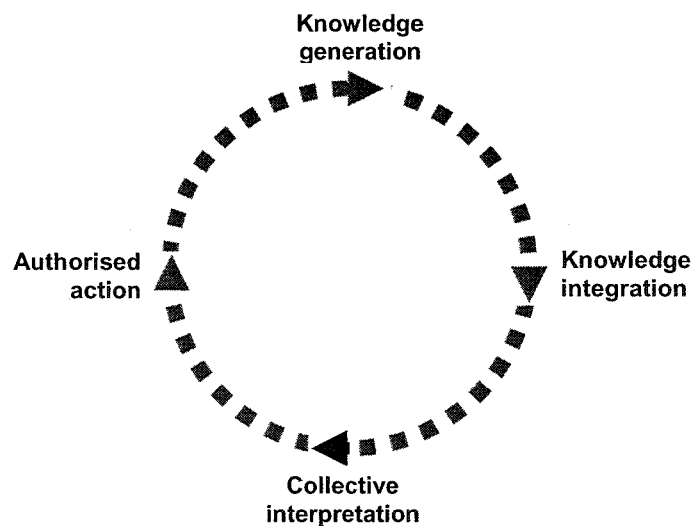
Figure 2.10
March and Olsen’s (1975) model of organisational learning cycle



2.6.2 Dixon's Model

Dixon (1999) proposes a four-step process or repetitive cycle of organisational learning that she believes it can facilitate change (see *Figure 2.11*). According to this model, step 1, the widespread generation of knowledge, is followed by step 2, which involves the integration of the new knowledge into the organisational context; and step 3, during which the information is collectively interpreted, and finally stage 4, through which organisational members are authorised to take responsible action based on the interpreted meanings of the learning.

Figure 2.11
Organisational learning cycles as proposed by Dixon (1999)



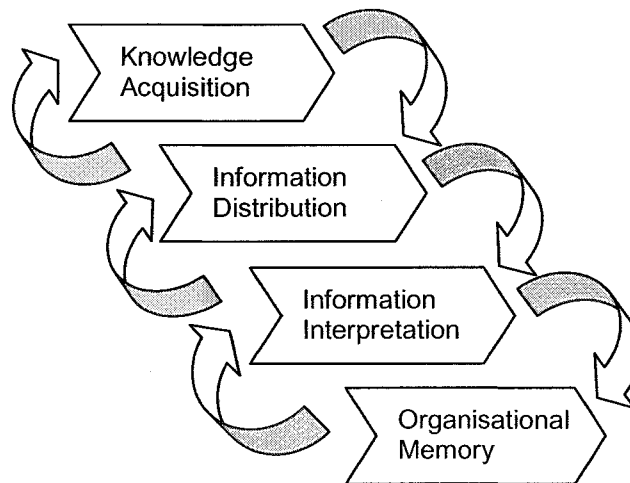
Other cyclical models include Kolb's (1984) experiential learning cycle, Boisot's (1995) social learning cycle, Robinson *et al.*'s (1997) learning cycle, Crossan *et al.*'s (1999) 4-I (intuition, interpretation, integration and institutionalisation) model and Nonaka and Takeuchi's (1995) knowledge development model.

2.6.3 Huber's Model

According to Huber (1991: 90), processes associated with organisational learning are knowledge acquisition, information distribution, information interpretation, and organisational memory. Knowledge acquisition is the process by which knowledge is obtained. Information distribution is the process by which information from different sources is shared and thereby leads to new information or understanding. Information

interpretation is the process by which distributed information is given one or more commonly understood interpretations. Organisational memory is the means by which knowledge is stored for use. The representation of Huber's (1991) model of organisational learning process is presented in *Figure 2.12*.

Figure 2.12
Interpretation of Huber's (1991) organisational learning process model

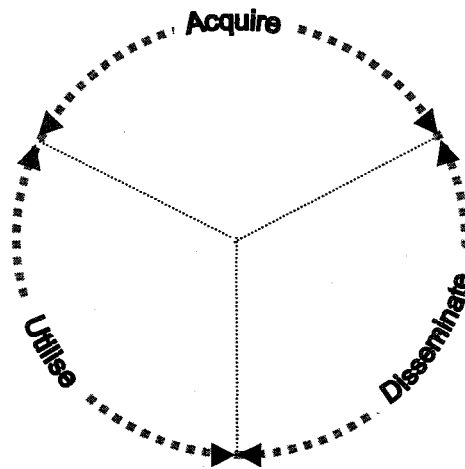


2.6.4 Nevis *et al.*'s Model

The Huber (1991) model assumes that the learning process has identifiable stages. This was then followed by Nevis *et al.* (1995) with their three-stage model: (1) knowledge acquisition – the development or creation of skills, insights, relationships, (2) knowledge sharing – the dissemination of what has been learned, and (3) knowledge utilisation – the integration of learning so it is broadly available and can be generalised to apply to new situations. Depiction of this model is presented in *Figure 2.13*. Nevis *et al.* (1995) suggest that studies of organisational learning must be concerned with all three stages in the process.

However, Nevis *et al.* (1995) have further tested this model in four learning organisations representing both service and manufacturing settings in US and European environments. They discovered that in fact organisational learning does not always occur in the linear fashion implied by any stage model. Learning may take place in planned or informal, often unintended, ways. They also found that knowledge and skill acquisition did take place in the sharing and utilisation stages, rather than being something that only occurs by organising an acquisition effort.

Figure 2.13
Nevis *et al.*'s (1995) organisational learning process model



2.7 Organisational Learning Mechanisms

For the learning of individuals to becoming organisational learning, a set of infrastructures is needed. These are known as ‘organisational learning mechanisms’. These mechanisms function as a bridge by which the learning of individuals in an organisation may be institutionalised into learning by organisations. This thesis follows the definition of organisational learning mechanisms by Lipshitz *et al.* (2002) and Amstrong and Foley (2003) with some adaptations.

Organisational learning mechanisms, in simple terms, are therefore defined as the observable organisational sub-systems in which organisation members interact for the purpose of learning. In other words, they are the context within which the process of learning takes place on behalf of the organisation. These can be in the form of formal or informal establishments. There are overwhelming instances of such mechanisms appearing in the literature (see, for example, Kululanga *et al.*, 2001; Prencipe and Tell, 2001; Franco *et al.*, 2004; Roth and Kleiner, 1998; Amstrong and Foley, 2003). However, the current study exclusively examines some key learning mechanisms that are relevant to construction companies, as suggested by the literature.

2.7.1 Mechanisms for Learning from Internal Sources

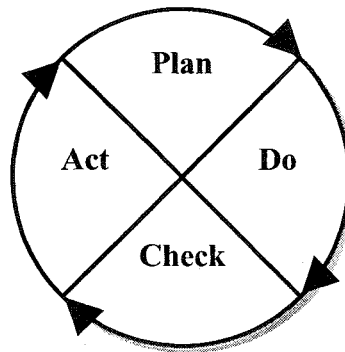
Knowledge domains exist both internal and external to the organisation. Internal knowledge develops from own experience (Huber, 1991). There has been a long-standing literature on learning curves that show companies benefit from their direct and cumulative experience in a focal activity. Numerous studies have shown a link between cumulative experience and performance improvement, such as greater labour productivity (Chambers and Johnston, 2000). Successful organisations not only encourage learning from one another internally, but also create internal mechanisms for reaping learning and developing lessons learned. Four learning mechanisms are identified as critical to construction companies for generating learning from internal sources. These are:

- (1) Quality circles;
- (2) Project reviews;
- (3) Lessons learned from failures; and
- (4) Lessons learned from project successes.

Use of Quality Circles

There is well established literature that analyses the link between quality circles and organisational learning (Pedler *et al.*, 1997; Zetie, 2002). A quality circle is a voluntary gathering of a group of employees, on company time, with an interest in solving a problem of mutual concern. It is generally assumed that through these discussions employees can generate solutions for improving the quality of their output (Gibson, 1982). Rosenfeld *et al.* (1992) extend the use of quality circles to raise productivity and quality of work life. On most occasions, a quality circle employs Shewhart's PDCA (plan-do-check-act) cycle principle in its activity (see *Figure 2.14*). Zetie (2002) argue that the PDCA cycle can be seen as a learning cycle similar to Kolb's (1984) experiential learning cycle. He further argues that the concept of "communities of practice" popularised by Brown and Duguid (1991) is essentially a quality circle.

Figure 2.14
The PDCA cycle after Shewhart and Deming (1986) used in the quality circle process



The centrepiece of a quality circle is the continuous learning process represented by the PDCA (plan-do-check-act) cycle. “The cycle is always depicted as a circle to emphasise a never-ending process” (Ahmad and Sein, 1997). A quality circle has the advantage of continuity, as the cycle remains intact from project to project.

The process of quality circles as above is, according to Kotnour (2000), parallel with the process steps of project management. Kotnour (2000: 395), by comparing the PDCA steps and project management steps, argues that “‘planning’ is the same, ‘do’ is ‘executing’, and ‘check’ is ‘control’. The ‘act’ step is the use of the lessons learned on the next project during the planning phases”.

Mark Goh (2000) has shown that quality circles are a good source of creating employee involvement, commitment and sharing ownership in the organisation’s processes. Through a longitudinal study of 28 British companies, Hill (1996a, 1997) provided some empirical evidence supporting the claims that quality circles can facilitate organisational learning. Whereas some authors have noted some difficulties in the application of such learning mechanisms in the context of project work, Pheng and Ke-Wei (1996) have developed a framework for implementing quality circles in construction.

Pheng and Ke-Wei (1996) suggest that one important step in developing a total quality culture in construction is to build a construction team of main contractor and sub-contractors who would commit to the quality process and develop a true quality attitude. Next, as general conditions, the client’s project specifications should specify the quality manager as part of the construction process. The quality manager would have the

ultimate authority for quality. Another recommendation is that the quality manager should be part of the main contractor's staff, because an outsider would be perceived as an inspector instead of a team member. A further recommendation addresses the tidiness of the construction site. One of the very basic requirements of a quality construction programme is that the construction site be kept clean. Materials and equipment must be neatly stored for future use. Lastly, Pheng and Ke-Wei (1996) recommend that another basic criterion for quality must be site safety. All standard safety practices must be followed during construction.

Project Reviews

Project reviews have been used by many organisations as a mechanism for distilling, as well as sharing, learning from projects (Franco *et al.*, 2004). It is through this mechanism that most lessons learned from projects are formally shared, relived and documented for future use. Von Zedtwitz (2002) defines a project review as "a formal review of the project examining the lessons that may be learned and used to the benefit of future projects". A project review can take place at any time, but usually either soon after the project has met a series of predetermined milestones or at the end of a project (Newell *et al.*, 2005). The term used to refer to such mechanism also varies. For example, as appeared in Leseure and Brookes (2004), terms like post-project reviews, post-mortems, and after-action reviews are used. Other variants include debriefs, project closure reviews, final project reviews, or project exit meetings.

As noted, the main purpose of project reviews is to draw and distil learning from a project. "Once the learning has been captured through this project review process, the reviews are then stored alongside other project documentation" (Newell *et al.*, 2005).

Busby (1999) has contributed by way of studying the conduct of post project reviews. He observes that, in general, the structure of project reviews in his samples were different. In the companies for which reviews were new, he found that the structure of the review matched the structure of the project. He explains that the chairmen in these companies "asked people to say how successful the outcomes were, and encouraged them to work out why the less successful ones turned so". In the experienced companies, he found that the chairmen asked people to compile individual lists of good and bad things they experienced about the projects, and then encouraged the participants

to group these under a set of common headings. In his findings, Busby (1999) concludes that the effectiveness of the reviews was not related to any form of structure. The successes and failings were reported to be common to the different structures.

In order to make such a review meet its purpose – that is to draw the lessons learned from a project – Callison and Parcell (2001) provide a set of practical recommendations for construction companies to follow:

- (1) call the meeting;
- (2) invite the right people;
- (3) appoint a facilitator;
- (4) revisit the objectives and deliverables of the projects;
- (5) revisit the project plan or process;
- (6) ask ‘what went well?’;
- (7) find out why these aspects went well, and express the learning as advice for the future;
- (8) ask ‘what could have gone better?’;
- (9) find out what the difficulties were;
- (10) ensure that the participants leave the meeting with their feelings acknowledged;
- (11) determine ‘what next’, and
- (12) record the meeting.

Lessons Learned from Failures

A learning company treasures its failures in order that it may learn from them. A lesson learned is “a catchall phrase describing what has been learned from experience” (Juran, 1988: 306). Weber *et al.* (2000c) extend this basic definition by describing it as a “validated working knowledge derived from successes or failures that, when reused, can significantly impact an organisation’s processes”. A lesson learned in construction may come from project successes or failures. Thus, the stone pit of learning from past performance “may focus on ‘negative’ lessons of failures, deficiencies, and other problems to be avoided, or on ‘positive’ lessons of innovative techniques and ‘best practices’ to be emulated” (Snider *et al.*, 2002: 68). Aspects of success and failure are fundamentally different in the way they determine learning, and therefore each merit

separate elaboration. This section concentrates on ‘the lessons from failures’ as its theme.

Learning from failure is a hallmark of learning companies (Cannon and Edmondson, 2006). Construction companies have to deal with failed projects over and over again, be they simply minor construction defects (Atkinson, 1999), onsite damage due to non-compliance of Health, Safety and Environmental requirements (Nishgaki, 1994), through to project management defects such as not completing their projects by the initial deadline or exceeding the budget (*The Economist*, 2005), to major construction design failures, which lead to catastrophic events (Hall, 1980). The American Society of Civil Engineers [ASCE] defines failure as “an unacceptable difference between expected and observed performance” (Feld and Carper, 1997). Thus, project failures include not only catastrophic events, such as the collapse of bridges, but also small repairable failures such as minor site defects and delays due to technical or managerial failures. Clearly, project failures occur almost regularly across construction businesses. It is therefore vital that lessons that can be learned from past events are extracted for future benefit (Campbell, 2001). Ilias Ortega (2000: 21) argues, “even though any construction failure is to be regretted, each failure provides information that may be used to prevent similar failures.” He expands on this by saying that systematic investigation of failures helps advance the science of construction and building regulations. The results of such investigations are then lessons learned that consist of things to be avoided and things to be improved. Thus, according to this author, each construction failure points to a gap either in theory or practice and thereby fosters leaning and innovations (p.21).

According to Wilkinson and Mellahi (2005: 233), “failure is a fact of life from which most organisations cannot escape”. What is then important for organisations is to learn from each of their failures. Generic learning theory suggests that learning is triggered by performance below aspirations (Cyert and March, 1963; Lant *et al.*, 1992). Failure upsets the status quo, draws attention to potential problems, and stimulates a search for possible solutions. Failure provides an incentive for organisational improvement (Miller and Chen, 1994). This is supported by Chuang and Baum (2003): “failures are vital engines for change, initiating exploration of new practices, strategies, and courses of action, rather than reinforcing continued use and refinement of current ones”. Various studies have provided evidence that failure in meeting certain performance criteria leads

to organisational learning, for example Lant *et al.* (1992) and Chuang and Baum (2003). Sitkin (1992) studies the impact of failure within the company and its use as a potential strategic asset. Miner *et al.*'s (1999) study extends to the impact of failures in a broader context, inter-organisational learning. However, Miner *et al.* (1999) also acknowledged that failure is not the only, or even the most important, stimulus for learning. In fact, the lessons learned from failures often reside longer in the organisational consciousness.

The reasons why projects fail vary. There is a variety of literature that examines the cause of project failures in the construction industry. For instance, Levy and Salvadori (1992) associate construction failures with knowledge deficiencies, such as: (1) knowledge not available and thus unavoidable, (2) delayed communication of acquired knowledge, (3) ignorance of recently acquired knowledge, (4) misunderstanding of accepted knowledge, (5) outright ignorance, and (6) incorrect procedures. Thornton (1985, in Yates and Lockett, 2002) categorises five general themes that cause construction failure due to: (1) design deficiencies, (2) construction deficiencies, (3) material deficiencies, (4) administrative deficiencies, and (5) maintenance deficiencies. In a study of 225 building failures in the United States, Wardhana and Hadipriono (2003) found that construction deficiencies such as unplanned demolition, poor workmanship, and unsafe excavation operations were to blame for failure. Hayden Jr (2004; 2006) study points to human related errors as a major contributor to project failures.

There is ample literature that has analysed failure in relation to organisational learning (e.g. Baumard and Starbuck, 2005; Cyert and March, 1963; Chuang and Baum, 2003). Behaviourists such as Cyert and March (1963) argue that companies are more likely to change their behaviours in reaction to failures than successes. If companies expect failures in their forecasts, they will search for alternatives. Thus, according to Cyert and March (1963), the prospect of failure stimulates behavioural innovation. On a similar theme, Sitkin (1992) reasons that moderate failures alert organisations to further potential problems, stimulate the search for solutions, and motivate people to improve. Some literature suggests that companies can avoid large failures by paying more attention to small failures (Cannon and Edmondson, 2006) or near failures (March *et al.*, 1991). Accumulated lessons learned from small failures and/or near failures can be

used to predict events leading to large failure. Sitkin (1996) refers to such knowledgeable failures as *intelligent failures*, which have the following characteristics:

- (1) they result from thoughtfully *planned actions*, that
- (2) have *uncertain outcomes*,
- (3) are *modest* in scale,
- (4) are executed and responded to with *alacrity* (eagerness), and
- (5) take place in domains that are *familiar* enough to permit effective learning.

Supporting the need to produce lessons learned from failures, Cannon and Edmondson (2006) insist that failure must be viewed not as a problematic aberration that should never occur but rather as an inevitable aspect of operating in a complex and changing world. This obviously does not mean that Cannon and Edmondson encourage people to make mistakes, but their message is “to acknowledge that failures are inevitable”, and their suggestion is “to learn as much as possible – especially from small ones – so as to make larger ones less likely” (p.316). Cannon and Edmondson (2006) further argue that “learning from failures is thus not impossible but rather is counter-normative and counter-intuitive”. Therefore, in order to make such process more common, they propose three essential activities through which organisations create lessons learned: (1) identifying failure, (2) analysing failure, and (3) experimenting.

Recognising the presence of technical and social barriers when engaging in the above activities, Cannon and Edmondson offer six recommendations based on their case studies of learning organisations that have implemented this idea into actions. Given that construction companies are the ones that should benefit most from cultivating learning from project failures, these recommendations are essentially applicable to them. *Table 2.12* summarises the recommendations of Cannon and Edmondson (2006) by relating the three activities of creating lessons learned and the two types of barriers that are associated with them.

Table 2.12
Framework for enabling learning from failures
(Adapted from Canon and Edmondson, 2006)

Key Processes in Creating Lessons Learned from Failure			
	Identifying failures	Analysing failures	Experimentation
Technical barriers	Complex systems make many small failures ambiguous.	A lack of skills and techniques to extract lessons from failures.	Lack of knowledge of experimental design.
<i>Recommendations</i>	<i>Build Lessons Learned Databases to capture and organise data, enabling detection of anomalies, and ensure availability of systems analysis expertise.</i>	<i>Formalise Post Project Review or other formal sessions that follow specific guidelines for effective analysis of failures, and ensure availability of data analysis expertise.</i>	<i>Identify key individuals for training in experimental design; use as internal consultants to advise pilot projects and other project experiments.</i>
Social barriers	Threats to self-esteem inhibit recognition of one's own failures, and corporate cultures that 'shoot the messenger' limit reporting of failures.	Ineffective project teams limits effectiveness of failure analysis discussions.	Organisations may penalise failed experiments, inhibiting willingness to incur failure for the sake of learning.
<i>Recommendations</i>	<i>Reinforce psychological safety through organisational policies such as blameless reporting systems, through training first line managers in coaching skills, and by publicising failures as a means of learning.</i>	<i>Ensure availability of experts in group dialogue and collaborative learning, and invest in development of competencies of other employees in these skills.</i>	<i>Pick key areas of operations in which to conduct an experiment, and publicise results, both positive and negative, widely within the company.</i>

Arguing that their idea of learning from failure may be perceived as an abstract ideal by some managers due to their traditional mindset, Cannon and Edmondson (2006) clarify this by providing some examples from a variety of organisations where failures are being mined and turned into good use through the above activities. These authors further argue their framework is best implemented as an integrated set of practices accompanied by an encompassing shift in managerial mindset. *Table 2.13* summarises this idea by placing the characteristics of the traditional mindset side-by-side with learning-oriented mindsets.

Table 2.13
Reframing the traditional managerial mindset for learning

	<i>Traditional Frame</i>	<i>Learning-oriented Reframe</i>
Expectation about failure	Failure is not acceptable	Failure is a natural by-product of a healthy process of experimentation and learning
Beliefs about effective performance	Involves avoiding failure	Involves learning from <i>intelligent failure</i> and communicating the lessons broadly in the organisation
Psychological and interpersonal responses to failure	Self-protective	Curiosity, humour, and a belief that being the first to capture learning creates personal and organisational advantage
Approach to leadership	Manage day-to-day operations efficiently	Recognising the need for spare organisational capacity to learn, grow and adapt for the future
Managerial focus	Control costs	Promote investment in future success

Lessons Learned from Project Successes

Success has been generally perceived as a key generator of learning (Miner *et al.*, 1999). Companies that build competencies by domesticating their own successful practices are said to be more competitive and efficient in their respected area. Organisations have a tendency to re-experience their successes and improve their performance over repetitions of the same task (Levintal and March, 1993). Often, successful practices are repeated and refined over and over again, leading to a best practice or standard practice model. Standard operating procedures induce companies to act automatically, but often unconsciously, thus result in prompt product/service deliveries and organisational efficiencies.

Levintal and March (1993) argue that lessons gained from success are privileged by organisational learning. In a recent study using an economic model to learn the optimal management of organisational knowledge (know-how), Lee and Steen (2007) found that information about successes is typically more useful than information about failures because past successes can be used to guide future actions. Successes lead to self-assurance and encourage managers to take risks (Levitt and March, 1988). Confidence in control over outcomes leads to learning before experiencing (Levintal and March,

1993). Some literature on learning from own experience also shows that past organisational success leads to strategic persistence – a tendency for companies to stick with strategies that have worked in the past (Audia *et al.*, 2000). Being competent in an activity leads to success, which in turn leads to greater competence. Thus, success fosters programming, and programming facilitates success, but mainly in a short run (Starbuck *et al.*, 1978).

Nevertheless, companies that build competencies based on past successes should be wary of the danger of ‘the success trap’. Shukla (1997) describes how successful companies try to replicate their achievements by formalising their effective practices and procedures, standardising their products and services, and investing in tried and tested technologies. This single loop approach to learning results in the organisation becoming less sensitive to competitive demands; they lose touch with their environment and as Shukla explains, “...their past learning becomes a hindrance in the way of the necessity of new learning; they must unlearn to learn” (Shukla, 1997).

In order to avoid the risk of the success trap, it is important that construction managers embrace balanced approaches between the exploitation of best practices and the exploration of new approaches. Best practices that have proven to be successful in one project should be documented and spread across projects. But these must also be updated in time through a mechanism such as lessons learned review meetings.

Lessons learned generated from a project success can take any shape and theme including design methods (Staub-French and Khanzode, 2007), constructability (Kartam, 1996), problem solving (Krizek and Hadavi, 1996), and management approaches (Nguyen *et al.*, 2004). However, Carrillo (2005) recommends the use of a standard template to ensure consistency across all projects. Documents should be indexed and stored electronically to facilitate ready access. Intranets may also be used to push alerts of the availability of lessons learned with the facility to drill deeper if required. Noting that there are various approaches to handling a construction project and that each is well-suited for a specific set of conditions, the use of lessons learned should be adapted to current and unique situations applying to the project at hand. No one approach can be judged “best”, Krizek and Hadavi (1996) remind, but rather any given approach must be evaluated in light of the prevailing work situations.

2.7.2 Mechanisms for Learning from External Sources

In addition to internal learning activities, organisations typically build their learning resources through externally focused activities such as benchmarking, technology brokering and environmental scanning (Adams and Lamont, 2003). The concept of explorative and exploitative learning put forward by March (1991) is basically trying to explain these processes. March (1991) contrasts activities of entrepreneurial search for new opportunities and solutions with adaptive and internally focused learning that leverages existing knowledge. Explorative learning is referred to as outward-looking learning by Pedler *et al.* (1997). It emphasises the generation of knowledge sourced externally through various mechanisms. This section discusses four learning mechanisms that are primarily used to generate learning from external sources. These are:

- (1) Use of project teams as learning sensors;
- (2) Use of marketing division to learn the market;
- (3) Use of special expertise to scan outside world; and
- (4) Use of benchmarking.

Use of Project Teams as Learning Sensors

Construction companies potentially rely on their project team's ability to transform information and resources into solutions by using their collective competencies, capabilities and knowledge assets (*c.f.* Koch, 2004). Learning from external knowledge is frequently gained through the interaction of project teams with external parties involved in the project. Marks and Lockyer's (2004) study demonstrates how project teams may function as a vehicle for knowledge and skill acquisition in software industries, which is arguably also applicable in other project-based organisations such as construction. Nonaka and Takeuchi (1995) have discussed extensively the role of project teams in the knowledge creation process. According to these authors, project teams that are brought together from different specialisations are the primary source of new knowledge. In the light of Wenger's (1998) "communities of practice" concept, such a project team may be functionally understood as an organisational artefact that tries to emulate some aspects of community processing knowledge leading to organisational learning.

Use of Marketing Divisions to Learn the Market

Learning from the market has been cited as key to innovation and greater company performance, especially in the literature on the 'market-driven company' paradigm (Weerawardena, 2003). The literature suggests that market-driven companies stand out in their ability to continuously sense and act on events and trends in their market environment (Day, 1994a; 1994b).

Marketing divisions of a company play the key role in these activities. They perform a wide variety of functions, such as providing a focal point for dealing with clients; strategy and planning including positioning, market research and organisational learning. Trim and Lee (2005) report that marketing managers typically devote time and effort to scan internal and external operating environments, in order that the organisation can be properly positioned in the market place. Typical environmental scanning activities conducted by marketing divisions include both looking at information – that is viewing, and looking for information – that is searching. Marketing divisions are responsible for the conduct of gathering, analysing, supplying and applying information – quantitative and qualitative – about the external market environment. A marketing unit is a coordinating point or nerve centre for setting policy, providing advice, and ensuring cooperation and team work relating to all aspects of marketing.

Use of Special Expertise to Scan the Outside World

Organisations scan the environment in order to avoid surprises, identify threats and opportunities, gain competitive advantage, and improve long-term and short-term planning (Sutton, 1988). Special experts that provide market intelligence services may be hired by a construction company to scan the outside world, such as in market mapping activities or market research. Antal and Krebsbach-Gnath (2001) and Massey and Walker (1999) identify external expertise (consultants) as an important means through which organisations may learn about the external world. Special expertise can also supply ready-made knowledge, data and information about the market situation, customer behaviours or industry trends. The extent to which an organisation can adapt to its outside world is dependent on knowing and interpreting the external changes that are constantly taking place. Thus, the use of special market intelligence experts for

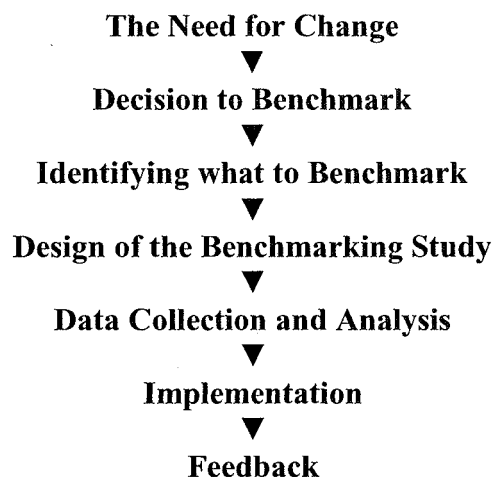
environmental scanning activities constitutes another mode of organisational learning. A study suggests that it may be more economical to purchase knowledge about the external world from specialty knowledge brokers than developing knowledge on your own (Killing, 1980).

Use of Benchmarking

Early benchmarking study is probably traceable to the work of Robert Camp (1989) who provides a working definition: “the search for industry best practices that lead to superior performance” (p.12). Benchmarking is essentially a tool for learning from others (Cox and Thompson, 1998). It involves a systematic search for the root causes of the best practices that influence superior performance. The lessons that may be learned from other companies through the conduct of benchmarking are used to establish improvement targets and to promote learning in the organisation.

Garnett and Pickrell (2000) proposed a 7-step model of benchmarking called “The Reading model” which they believe to be the most relevant to construction (see *Figure 2.15*). The key features of each stage and their relevance to construction are as follows:

Figure 2.15
The Reading model of benchmarking for construction



- (1) *The need for change* – Benchmarking should start with a question as to whether change is necessary. If the organisation is ready to accept change, then the question arises as to who will take the responsibility for any initiatives. Garnett

and Pickrell (2000) state that the construction industry has been unsuccessful with many previous initiatives because their basic questions were not asked.

- (2) *The decision to benchmark* – Because there are many examples of improvement techniques available, the suitability of benchmarking needs to be established first. Benchmarking is an excellent technique. However, it does require sufficient resources and therefore a decision has to be taken on its use.
- (3) *Identifying what to benchmark* – A number of tools are used to identify what to benchmark, such as the use of organisational charts to identify the level of business, process mapping workshops, customer focus, added benefit and quick wins can be considered. Critical success factors and strategic metrics are applied to the chosen core area. This stage is essential in identifying manageable focus for the study.
- (4) *Design of the benchmarking study* – Early preparation allows identification of the most appropriate type of benchmarking. The outputs from this stage include a confidentiality agreement, a partners' charter and the framework for a pilot study.
- (5) *Data collection and analysis* – This traditionally commences with a pilot data collection phase, from which partners identify what is available, from whom and how it is held within their organisations. The analysis phase should not be underestimated, and requires a dedicated person within each organisation. Communication of the results is crucial to getting the messages across and underpinning implementation of change.
- (6) *Implementation* – The data collection phase provides both a benchmark from which to commence and, by identifying best practice for each metric within the partnership, a base from which to set goals. Monitoring and re-calibration stages are agreed and all those affected are kept involved and informed.
- (7) *Feedback* – As benchmarking is a continuous process, feedback is essential. This may be communicated in a number of ways consistent with the groups receiving information. At this point a continuous monitoring and improvement strategy is identified for the area benchmarked, and new areas are identified for further studies.

Garnett and Pickrell (2000) argue that although the model is illustrated as a formal approach, it is very flexible in the order of the stages, what is measured, and how this is achieved.

2.7.3 Informal Knowledge Sharing Mechanisms

Informal learning studies have their origin in the works of John Dewey (1938), Kurt Lewin (1935) and Malcolm Knowles (1950). Dewey (1938) theorised that learning takes place through an individual's experiences in everyday activities. Knowles (1975) and Brookfield (1981) associate informal learning to the 'autonomous', 'independent' and 'self-directed learner'. According to Watkins and Golembiewski (1995), "90 percent of workplace learning is informal or incidental". Informal learning is based on conversations, social interactions, and team projects, in which learning is part of the interactions between people. Informal learning is self-motivated and self-directed and can occur intentionally as well as accidentally (Marsick and Watkins, 1990).

Informal learning is often distinguished from other kinds of learning by the fact that "it is non-intentional" (Wain, 1987: 48). Reber (1993) equates the process of informal learning to the acquisition of knowledge independently of conscious attempts to learn and in the absence of explicit knowledge about what was learned. However, according to Megginson (1996), the occurrence of informal learning can actually be planned or emergent. It can also be deliberately encouraged by an organisation (Marsick and Watkins, 1990: 12). Therefore, the provision of certain mechanisms for facilitating informal learning and knowledge sharing should be high in the management priorities of construction organisations if they wish to capture the benefits of their employees' informal knowledge.

An interesting article on "Trends in Workplace Learning" in the *Training and Development Journal* notes:

"... most of what people know is learned on the job just by talking to other people, milling around the coffee pot, trying out new things, and doing their work. Formal training, though essential, cannot serve as a substitute for these powerful, informal means of learning" (Bassi *et al.*, 1998: 56).

This confirms that the significance of informal learning to overall organisation learning is widely acknowledged. Thence, it is hypothetically argued that what makes the competent learning company unique is its conscious intention to legitimise and create space for such informal learning. This may be accomplished through a variety of mechanisms. This thesis identifies six potential mechanisms relevant to construction companies as derived from literature:

- (1) Social activities and informal gatherings;
- (2) Personal networks;
- (3) Informal storytelling sessions;
- (4) Onsite information exchange;
- (5) Exchange of personal notes; and
- (6) Personal (voluntary) case writings.

Social Activities and Informal Gatherings

Social activities and informal gatherings, such as company organised sport tournaments, cultural parties and group tours, can facilitate the meeting of all employees and managers in a more refreshing way. The idea of supporting this informal socialisation mechanism is the realisation that knowledge sharing typically occurs in unintentional ways where people meet and ‘interact’ with each other within a social context. Interaction refers to a reciprocal effect or influence between two or more people, where the behaviour of one may act as a stimulus for the behaviour of the other. Learning that occurs through these social mechanisms is said to be effectively useful to re-conceptualise one’s belief and perceptions (Kohlberg, 1981).

Social activities and informal gatherings also serve an important role with respect to collective awareness. Most would not refute the fact that one stays updated about other projects and new events partly through news bulletins on the intranet, and partly through social activities and informal gatherings. Thus, in this sense, it seems very relevant to view knowledge sharing as naturally a social process. Social learning theory posits that knowledge resides within cultures and that social meanings are shaped through communication with others (Rogoff, 1990). The same is said to be true of knowledge development (*i.e.* creation and dissemination) that typically occurs in communities, where people work and play in a mix of interactive activities (Blackler,

2002: 63). Thomas Davenport and Laurence Prusak (1998) believe that 70–80% of learning may be informal. They consider that working knowledge in the organisation is often transferred through people networks where chatting, conversations, luncheons and other less formal activities are practiced. Informal gatherings and socialisation allow the tacit knowledge resident in a group to emerge and be exchanged. In this endeavour, organisations like Johnson and Johnson and The World Bank have established 'Knowledge Fairs' or 'Knowledge Exchanges' to promote informal gatherings between employees to encourage knowledge sharing (Liebowitz, 1999, 2001).

Personal Networks

Herbert Simon (1991) suggests that shared learning is not restricted to formal economic relations but is more widely spread amongst each individual's wider set of relationships. These personal networks include suppliers, clients, competitors, family, friends, colleagues, consultants, bank managers, *etc.*, which according to Lave and Wenger (1991) are central to the learning process in an organisation.

Informal personal networks are relationships developed between individuals independently of any formal structure, and are not the chance meetings at the water cooler or cafeteria that Davenport and Prusak (1998) discuss. Developing and maintaining personal networks is based on the principles of reciprocity, that is, exchanging things with others for mutual benefits, and confidentiality. Personal networkers are identified as nodes that keep networks alive by their links with other nodes (Bonifacio *et al.*, 2002). Their links are defined by their social or personal relationships with others.

Juanita Brown and David Isaacs of the MIT Center for Organisational Learning report an interesting finding from their studies and conclude that the most powerful organisational learning and collective knowledge sharing grow through informal relationships and personal networks (Brown and Isaacs, 1996). A survey study into the Australian Defence Organisations by teams from the Enterprise Social Learning Architecture [ESLA] reveals that 'personal networks' and 'meetings' were ranked as the most preferred non-technology information sources (Ali *et al.*, 2002). Moreover their data pointed to information technology being used as a vehicle for better utilising personal networks, complementing rather than replacing person-to-person contact.

Other researchers such as Cross *et al.*, (2002) also share similar findings and point out that engineers and scientists were roughly five times as likely to turn to friends or colleagues for information as to impersonal sources.

Grabher and Maintz (2006) differentiate personal networks as project networks, sociality networks and connectivity networks. These three different types of personal networks are distinguishable in terms of the duration, focus, contents and governance of ties (see *Table 2.14*).

Table 2.14
Nature of ties in personal learning networks
(Adapted from Grabher and Maintz, 2006: 5)

<i>Dimension of ties</i>	<i>Type of personal networks</i>		
	<i>Project networks</i>	<i>Sociality networks</i>	<i>Connectivity networks</i>
Duration	Limited (project)	Lasting (biography)	Sporadic (theme)
Focus	Task oriented	Career oriented	Theme oriented
Contents	Know-what	Know-whom	Know-how
Governance	Procedural authority	Networked reputation	Professional ethos
Virtual forum	Collaborative work-space	Social networking software	Weblog; online discussion forum
Virtual interaction style	Synchronous and asynchronous many-to-many	Asynchronous one-to-one	Asynchronous one-to-one; many-to-many

The division of informal networks such as the above are especially germane in the project-work construction business. Construction has long been analysed as a craft-based industry (Stinchcombe, 1959), meaning less formal organisational arrangements. It is in the construction industry that one can expect to see organisations which rely, to a considerable extent, on stable and enduring personal networks based on loyalties and friendships cemented over time (Eccles, 1981; Stinchcombe, 1959). More often than not, instances such as repeat business in construction are awarded based on maintained personal networks. This is particularly true in the case of relationships between main contractors and subcontractors or suppliers. Project managers and employees of construction companies also regularly form their own informal communities of expertise from where they can obtain necessary pieces of knowledge (Bhatt, 2002). Despite the explosion of information that is accessible through the Internet and

databases, people in construction still rely heavily on their networks for help with their work (Cross *et al.*, 2002).

Informal Storytelling Sessions

Storytelling is traditional and was an ancient means of passing on wisdom and culture. Recently, the use of storytelling as a mechanism for learning in organisations has been critically analysed by numerous scholars (*e.g.* Denning, 2001; Snowden, 1999, 2000a, 2000b; Kaye and Jacobson, 1999; Abma, 2003; Brown *et al.*, 2005). Denning (2005: 167–172) establishes the characteristics of narrative and storytelling that account for their pervasiveness in organisations: (1) stories are salient to the lives of people in the organisation; (2) help individuals to make sense of organisations; (3) can communicate holistically; and (4) are a large part of the economy; (5) narratives communicate naturally, collaboratively, persuasively, intuitively, feelingly, interactively, entertainingly, and movingly so as to get action; (6) storytelling is quick and powerful, memorable, and is free; (7) storytelling communicates context; (8) flies under the corporate radar; (9) spurs double-loop learning; (10) builds authenticity; and (11) re-connect the speaker with the spoken and the knower with the known; (12) storytelling is key to leadership, and (13) storytelling skills are easily upgraded.

“Stories are immediate and unique” (Denning, 2001). They can be a very powerful way to represent and convey complex, multidimensional ideas. “In story both medium and message become one” (Cash, 1997). According to Snowden (2000), well designed, well told stories can convey both information and emotion, both the explicit and the tacit, both the core and the context. Ruggles (2002: 2) describes stories as great “vehicles for wrapping together many elements of knowledge”. Storytelling brings people together in a common perspective, and stretches everyone’s capacity to empathise with others and share experience (Denning, 2001, 2005).

Storytelling is a powerful tool for sharing tacit knowledge, norms and values (Randall and Martin, 2003), developing trust and commitment, generating emotional connection, forming organisational ethics and morality (Poulton, 2005), and facilitating organisational unlearning (Johannessen and Hauan, 1994). It has also been constructively employed to communicate embedded knowledge, instigate change, simulate problem solving and prompt sense making. The extant literature also theorises

the potential of the storytelling mechanism in relation to helping to establish organisational identity (Paalumäki, 2000), creating and maintaining interpersonal relationships and facilitating interpersonal learning (Rae, 2005). In a more recent study, Nielsen and Madsen (2006) demonstrated how storytelling can be used for sharing knowledge across projects. They explained that a storytelling session creates a process that lets the participants both reflect on their own practice through comparison with others' and creates a process through which they can learn from other partakers' experiences.

It may be advantageous to promote voluntary storytelling in a construction organisation for a number of reasons (Boyce, 1996). First, informal storytelling sessions allow organisation members and clients to express their respective experiences. Second, through storytelling sessions the shared experiences and shared meaning of individuals and project teams within the organisation can be sustained. Third, storytelling is an effective tool for orienting and socialising new organisational members. Fourth, it is also particularly efficacious for altering or amending the organisational reality. Fifth, it is a venue for developing, sharpening and renewing the sense of purposes held by organisation members. Sixth, storytelling can prepare project teams for planning, implementing plans and decision making in line with shared purposes. Seventh, the storytelling mechanism can play a major role in co-creating vision and strategy.

Onsite Information Exchange

Onsite information exchange refers to the practice of sharing or exchanging information between parties onsite of a construction project. The information exchanged can be varied, including official documents regarding scheduling, cost control, quality assurance, or contract management (Zhiliang *et al.*, 2004). Shohet and Frydman (2003) distinguish five topics of information being exchanged by construction managers and their project teams:

- construction instructions;
- materials and equipment;
- quality management;
- allocation of manpower; and
- cost control.

It is well-known that the practice of information exchange between project members onsite of a construction project is mostly carried out informally, either through face-to-face verbal communication, exchange of electronic files or paper documents, informal meetings or telephone conversations. Such informal communications are said to be more effective for discussing sensitive information in a project. Shohet and Laufer (1991) compare the times spent by construction foremen in exchanging information in practices in the USA and Israel. They found that foremen in both countries spend more than 50% of their time discussing work methods with their subordinates.

According to Stewart and Mohamed (2004), the ease of information exchange within a project organisation can have a significant effect on construction productivity. The aim of any information management is therefore to provide support for facilitating the exchange of information between parties in construction projects. Baldwin *et al.* (1999) demonstrate the use of information technologies to support information exchange in partnering projects. Their survey confirmed that both construction partners and clients have reciprocating benefits from the use of Information Exchange [IE] technology, which together produce a significant impact on the project performance.

The underlying assumption of facilitation of information exchange onsite is that the easier and faster the exchange processes, the more learning is involved. Various tools and mechanisms are available to facilitate onsite information exchange such as peer-to-peer computing (Loo, 2003; Desouza and Evaristo, 2004), electronic information exchange (Baldwin *et al.*, 1999), XML technology (Zhiliang *et al.*, 2004), wireless communication (De-la-Garza and Howitt, 1998), use of PDA as mobile computing (Kimoto *et al.*, 2005), knowledge sharing platforms (Lin *et al.*, 2006), or simply by providing relaxing facilities such as office games or coffee rooms (Desouza, 2003a). Desouza (2003b) points out that “by making knowledge sharing a pleasurable experience, employees were more inclined to take special efforts coding tacit knowledge into an electronically transmissible format”.

Exchange of Personal Notes

Personal notes are typical record systems used as a memory aid for individuals to remember important facts, actions, ideas and decisions (Markus, 2001). Personal note-taking is common practice in meetings, interviews, lectures, formal/informal

discussions, seminar, *etc.* It has even been claimed that note-taking is indeed an effective strategy for learning (Trafton and Trickett, 2001). Note-taking is often practiced in an informal or unstructured manner. The notes are frequently written in notebooks, although any available piece of paper can suffice in many circumstances.

At the outset, most individuals create personal notes for their own personal use (Markus, 2001). However, in collaborative construction work, it is common to exchange personal notes among project members; for example notes taken during a project meeting (Selvin *et al.*, 2001). In such situations, the notes should be made readable to others, and thus require a suitable type of proper writing methods. *Table 2.15* outlines five different methods of note-taking commonly used in the workplace:

Table 2.15
Description of different note-taking methods

<i>Methods</i>	<i>Description</i>
Cornell method	The Cornell method provides a systematic format for condensing and organising notes without laborious recopying. A strip of white space is left to the left side of the notes, which are written as they come up. In the white space, one summarises concepts once they become clear. In that way, the method requires no rewriting and still results in systematic notes.
Outlining	Whilst notes can be written freely, many people structure their writing in an outline. Dash or indented outlining is usually best. The information that is most general begins at the left with each more specific group of facts indented with spaces to the right. The relationship between the different parts is carried out through indenting.
Mapping	Ideas are written with lines connecting them together in a tree-like structure. Mind maps are commonly drawn this way, but with a central point, many colours, little graphics and anything that helps to visualise the information easier. It is a method that maximises active participation, affords immediate knowledge as to its understanding, and emphasises critical thinking. It is also used for planning and writing essays.
Charting	Charting means that one creates a table with rows and columns. This method is good for facts and relationships.
Sentence method	Every new thought is written in a new line. This method is good in terms of speed since there is not as much thought needed, such as finding the layout and creating enough space for more notes.

According to Markus (2001), when people knowingly create documents that they know others will read, they consciously or unconsciously shape their records into public documents. If the others for whom they are writing are quite similar to them in term of knowledge, the extent of the shaping can be relatively minor, because the readers can be expected to be familiar with much of the general and specific knowledge that went into producing the record. And, having shared goals and interests, they can generally be trusted to reuse the information in acceptable ways. Therefore, less effort is required to shape the public face of the document.

From studies in the educational context, Kiewra *et al.* (1991) demonstrate how notes exchange (“borrowed notes”) would have benefited not only the note-takers but also others who borrow the notes. Lynn *et al.* (1999) argue that the findings of Kiewra *et al.*’s (1991, 1988) studies can have direct application to team settings where team members will frequently rely on notes taken by others (*e.g.* customer requirements document recorded by marketing and used by engineering). The same is true for sketch notes taken by architects and used or shared by quantity surveyors and carpenters.

With the emergence of digital writing, computers, particularly tablet personal computers [PCs] and personal digital assistants [PDAs], are beginning to see wide use as note-taking devices. Bush (1945) envisioned the use of personal memory systems to store rich information six decades ago. Today, all that Bush imagined has become common practice (Engelbart, 1984; Chiu *et al.*, 1999). Personal memory systems including personal notes have evolved into digital format, thus are quicker and much more transferable (Wirth, 2003). In addition to their role as knowledge sharing mechanisms, notes or e-notes can also be designed to facilitate onsite problem solving (Trafton and Trickett, 2001).

Personal Case Writings

A personal case writing can be an effective means of converting personal tacit knowledge into explicit knowledge. Tacit knowledge is highly personal and hard to formalise, making it difficult to communicate or share with others (Polanyi, 1962). Tacit knowledge is deeply rooted in an individual’s actions and experience as well as in the ideas, values or emotions. The larger parts of knowledge in construction projects, such as informal personal skills or crafts (know-how), reside in the minds of individuals

(Tserng and Lin, 2004). This type of knowledge can not be easily transferable without first making it explicit. Nonaka and Takeuchi (1995) refer to such a conversion process as 'externalisation' – individual knowledge becoming public knowledge – taking the shapes of analogies, concepts, narrations and stories. Cases, like the telling of a story, reflect problem situations in real life and contain a rich contextual knowledge.

A case voluntary written by project members or staff may contain a personal account of project experience or events in which they have taken part or have witnessed personally. Such reports would contain the individuals' own reflections on the events (Bailey *et al.*, 1997; Boyd and Fales, 1983), which may entail learning and problem solving.

Informal case writing can facilitate learning and knowledge sharing on at least two different levels. At the individual level, it entails reflective activities that induce personal learning. Informal cases written by project members may be shared and analysed at the project review meetings at the end of a project in order to develop their learning. Together with formal project records, personal cases function as a useful memory system for organisational learning (Probst, 2002).

Informal case writing may take any form without a need to follow a standardised method. Nevertheless, Pyatt (2006) suggested at least two common elements should be covered in any form of case writing for effective learning.

- *Real world scenario*

Cases are generally based on real world situations, although some facts may be changed to simplify the scenario or 'protect the innocent'. For example, due to the sensitivity of information in a construction project, anonymity may be used in a story.

- *Supporting data and documents*

An effective case writing typically includes real artefacts in the forms of simple data, tables, links, quoted statements or testimony, supporting documents, images, videos, audios, or any other appropriate material.

2.7.4 Formal Knowledge Sharing Mechanisms

Some literature concerning organisational learning studies has emphasised the learning process through formal mechanisms such as routines, structures, procedures and rules (March and Cyert, 1963; Fiol and Lyles, 1985). There are various formal learning mechanisms available in the literature. The following six mechanisms for sharing knowledge are relevant to construction companies. They are considered as formal in that their establishments are structurally planned and institutionalised at the organisation level.

- (1) Communities of practice.
- (2) Inter-project visits.
- (3) Use of intranet.
- (4) Company newsletters.
- (5) Lessons learned databases.
- (6) Standardisation of methods and best practices.

Communities of Practice

A community of practice consists of individuals with a shared domain of expertise who voluntarily share knowledge about practices that matter to them (Gary, 2004). Etienne Wenger defines communities of practice as “group of people informally bound together by shared expertise and passion for a joint enterprise” (Wenger and Snyder, 2000: 139). In the context of the construction industry, they are usually formed within a single work specialisation in order to focus efforts in sharing knowledge or experience and solving problems. Their organisational forms or networks may be formal or informal. Jewell and Walker (2005) provide instances of different communities of practice created by one UK construction company that range from purely social groupings, like a five-a-side football tournament, to a highly structured community of practice to support the implementation of their internal Fast Tract Management Programme. Other examples include those that were reported by Peansupap and Walker (2005) in three large Australian construction companies. They distinguish between the ‘within-organisational’ networks (*e.g.* technical support, project manager/engineer focused, and collegial support) and ‘cross-organisational’ communities of practice networks that

organically emerge as a result of people sharing an interest or experience in something significant (Peansupap and Walker, 2005: 91).

However, Wenger *et al.* (2002: 27) observe that all communities share a basic structure despite the variety of forms they take. Meanwhile, Smits and DeMoor (2003) compare communities of practice and project teams. They argue that communities of practice and project teams are culturally different in social structure. Therefore, these need to be considered when attempting to institutionalise communities of practice in construction. Peansupap and Walker (2005) have the same observation and summarise the differences as depicted in *Table 2.16*.

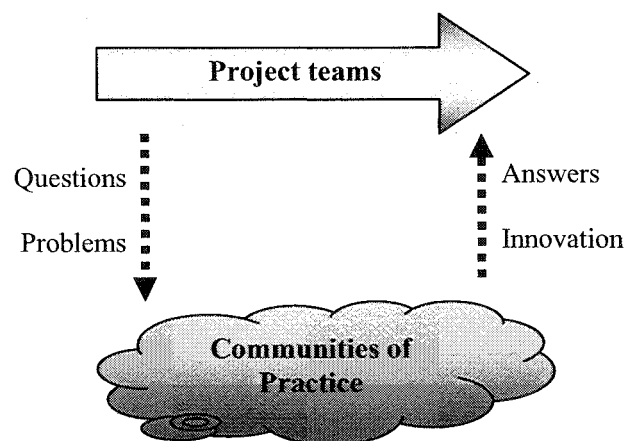
Table 2.16
Differences between teams and communities of practice
(Reproduced from Peansupap and Walker, 2005: 94)

	<i>Project teams</i>	<i>Communities of practice</i>
<i>Nature of formation</i>	Selected through resourcing processes.	Generally formed through voluntary and informal processes.
<i>Term</i>	Temporary and finite: until the project is complete.	It depends: the community of practice will remain as long as its members consider it has a purpose.
<i>Duration</i>	Set up specific time period for team joining; team member will be desegregated after finishing the project.	Do not specify time; the membership of communities of practice will end when the members feel that it is no longer in their interest.
<i>Structure</i>	Each team member will have a specific role and 'place' in the team.	Peers with a common purpose.
<i>Purpose</i>	Deliver the 'result' (e.g. building); organisation determines a specific goal and time to achieve the goal.	Sharing of knowledge; members determine group interest and share their knowledge in natural manner.
<i>Operating principle</i>	Command and control.	Collaboration and commitment.
<i>Legitimisation</i>	Formal hierarchy/leadership.	Informal and dynamic/fluctuating membership; status in communities of practice must be earned.
<i>Essential success ingredients</i>	Trust, shared 'vision', and purpose; commitment.	Trust, shared 'vision', and purpose; commitment.
<i>Type of knowledge</i>	Explicit knowledge and information (documentation, processes, report).	Tacit knowledge (stories, practical experience, lessons learned, tips).
<i>Communication mode</i>	Formal (formal meeting).	Informal (social activity and peer group, conference); <i>ad hoc</i> and informal meeting.

Noting the above, Peansupap and Walker (2005) maintain that the distinction between communities of practice and project teams is palpable and relevant because there is often a different purpose for the two. However, they further argue that an organisation may take the benefit of integrating communities of practice with any given project team by injecting a combination of informality and formality. Wenger *et al.* (2002: 51) confirm the need of some formalities when developing and nurturing communities of practices, for example by providing a set of guiding principles or governance arrangements.

Shawn Callahan (2006) introduces the idea of ‘the arrow and the cloud’ to describe how project teams can provide direction for communities of practice and in return how communities can support teams (see *Figure 2.16*).

Figure 2.16
Callahan’s (2006) ‘arrow and cloud’



The *arrow* represents projects and the *cloud* represents a community of practice. Callahan (2006) explains that a successful project has a clear direction and definite deadlines to meet and that most organisations focus their resources on the arrow. On the other hand, a community of practice is more interested in the learning journey than the destination and often the outcomes are less clear. He then argues that although the arrow and the cloud are quite different organisational entities, one informs the other.

Callahan (2006) further illustrates an instance where project teams and a community of practice may interact with each other. For example, when project teams face challenges and problems, they may pose questions to a community of practice that exists within the

organisation. Mutually, a community of practice can take benefits from this 'real world' problem to focus its efforts on a subject that is valued by the organisation.

From their recent studies of UK and Australian construction companies, Jewell and Walker (2005) and Peansupap and Walker (2005) conclude that communities of practice are 'out there' already in most construction organisations. They just need to be recognised, institutionalised and nurtured in order for an organisation to benefit from their potential for knowledge sharing and learning.

Coakes (2006) identified six main resources or facilities that communities of practice require in order to operate effectively:

- (1) A space to meet – this could be provided online through software that permits discussion groups, e-forums, threaded discussions, online chat-rooms for instant communication and virtual meeting rooms.
- (2) A place to store ideas – virtual discussions of course are easily stored in discussion threads and best practice databases that are generated and extracted from these discussions.
- (3) A memory of activities – databases storing content and documents, virtual presentations; webinars and possibly also on-line courses can provide this memory.
- (4) A record of members and their interests – member profiles once stored on a database provide the community with not only a pool of searchable expertise, but also with the ability to link members with similar interests to enhance social networking within the community.
- (5) A means of communication amongst communities of practice members – the high-technology format for this is video-conferencing with all its requirements for well-supported technical assistance and resources; the low-technology version is one that can be utilised by any home PC user, such as web cam and a telephone.
- (6) Ways to share tacit knowledge – this is of course very difficult to utilise technology to perform; instead it may be best to provide a facilities that facilitate direct interactions between members.

Inter-project visits

Inter-project visits allow project teams working in different sites to learn and share their experiences in addressing common problems. Because much of the knowledge in a project seems not to be transferable easily without direct attendance (Nonaka and Takeuchi, 1995), it is becoming clear that learning between projects may be best attained through sending project teams to different sites. Sole and Edmondson (2002) promote the use of periodic inter-site visits in order to create 'bridges' of firsthand experience that foster insight into practice-based knowledge from other sites. In a study of dispersed teams, as Sole and Edmondson (2002) observe, inter-site visits contributed to a shared history with other members of the team, greater familiarity with the extended team context, and the transfer of insights back to the home location.

Studies on learning through visits have realised the advantage of inter-project visits as a powerful mechanism for facilitating knowledge exchange in organisations (for example, see Almeida and Kogut, 1999; Huysman *et al.*, 2002; Sole and Edmondson, 2002). Disterer (2002) postulates that project team members can be the main carriers of knowledge, and Simon (1991) stresses that in fact all knowledge resides in human heads. In agreement with Simon, Myers (1996) points out the necessity of understanding knowledge as tied to the personal or human element. All this implies that any effort involving 'transfer of knowledge' should not be thought of independent of human participation or involvement. The terms 'client participation' (Davenport and Smith, 1995) and 'early involvement' (Song *et al.*, 2006) in construction lingo, for example, stand for ways to absorb and transfer knowledge from other project participants (*i.e.* clients, contractors, subcontractors, suppliers, *etc.*).

The belief that inter-project visits can facilitate learning is undisputable. Recent research by Mike Morris *et al.* (2006) indicates that inter-project visits are common practice in the firms they studied and that indeed knowledge sharing and transfer took place in such learning networks. A case study research by Andrew Dainty *et al.* (2005: 27) in a Hong Kong-based construction company shows that the company has a sophisticated 'site visit programme' as part of its long list of knowledge sharing techniques. The aim of the programme was to transfer lessons learned during projects to others within the organisation whilst their experiences remained fresh in their minds. Dainty *et al.* (2005) report that site visits were considered a particularly efficient method of knowledge

sharing, particularly as staff liked to showcase their successes and innovative practices in their project.

The practice of sharing knowledge and of enhancing learning through a visit is by no means new. Japanese companies have long been reported as using inter-plant visits for building their competitive advantage. For example, Toyota has successfully fostered an open knowledge sharing network among its suppliers (Dyer and Nobeoka, 2000). Inter-plant visits allow members of the network to learn from each other about new processes or best practices. In a rather similar fashion, the International Labour Organisation's FIT Programme has promoted a knowledge sharing mechanism based on inter-organisation visits called 'enterprise visits' (Tanburn, 2000).

Use of Intranet

Intranet stands for intra-organisational network. It is the application of Internet technology, more specifically World Wide Web technologies, within an organisation in order to support an organisation's internal information needs (Damsgaard and Scheepers, 2000). Such information is often document-centred since documents permeate much of organisational practice (Brown and Duguid, 1996). An Intranet is basically the use of Internet but access is restricted exclusively to organisation members. It is an internal informational system that employees might be encouraged to use as a daily part of their work routine. According to Harvey *et al.* (1998), the underlying philosophies behind Intranet usage are (1) information pull: the user determines what and when to access the information resources and (2) information push: providing continuing updates of breaking news to all organisational members. This differs from the information push of traditional corporate environments where memos, employee handbooks, and reports are distributed to all organisational members on a given distribution list. The information received by a user may or may not be useful at the time received.

The common functions of Intranets are designed to provide a means for storage of and access to electronic archives (Olivera, 2000). Yet, the use of Intranet technology has substantially evolved from a mere internal method of storing information and knowledge sharing, which grew out of groupware, to a more sophisticated and complex organisational tool (Jacko *et al.*, 2002; Carlson, 2000; Ji and Dalvendy, 2004).

Intranet technology is multipurpose. Damsgaard and Scheepers (1999) summarise five potential uses for which Intranet technology can be applied simultaneously (see *Table 2.17*).

Table 2.17
A summary of Intranet technology use modes

<i>Use mode</i>	<i>Description</i>
Publishing	Using the intranet technology to publish information (e.g. newsletters, technical documents, employee directories, company policies, standard practices)
Transacting	Using the intranet technology to transact with functionality on intranet pages and other organisational computer-based systems (e.g. inter-department or inter-project transactions)
Interacting	Using the intranet technology to interact with other individuals and group in the organisation (e.g. via discussion groups, collaboration applications, forums)
Searching	Using the technology to search for organisational information (e.g. via search engines, indexes, search agents)
Recording	Using the technology to record the computer-based organisational memory (e.g. best practices, business processes, frequently asked questions, lesson-learned, project databases)

Intranets function as a formal knowledge sharing mechanism by providing a venue where organisation members are linked to collaborate, coordinate and communicate in their daily work practices. Intranet infrastructures are provided by the company and are increasingly being used as a platform for developing and deploying applications to support business operations and management across the interworked enterprise. According to Harvey *et al.* (1998), the Intranet provides support for transferring knowledge and facilitates organisational learning through the following ways:

- (1) stimulates learning between management levels in the organisation;
- (2) expands of a learning environment across function;
- (3) encourages learning between divisions within the same organisation; and
- (4) bolsters learning between operational units or projects.

In a more specific application to construction, an intranet can play a valuable role in supporting knowledge sharing by (Robertson, 2004):

- providing a collaborative environment that can be used by organisation members to share their learning and experiences, even if they are located in different offices or sites;
- offering a mechanism by which individuals or project teams can disseminate their project experience to the rest of the organisation; and
- staff directories help to connect staff in an organisation, *e.g.* via a function such as expertise finders.

Company Newsletters

Sullivan and Scattolon (1995) recommend the use of newsletters for promoting knowledge sharing between consumers. Knipstein (2007) advocates the use of newsletters as an effective non-threatening tool for delivering messages to a non-direct employee audience common in construction companies. A recent study of construction companies by Egbu *et al.* (2005) also mentions the use of newsletters as one alternative venue for knowledge sharing being suggested by their site manager respondents.

Newsletters or periodicals remain widely used as a formal mechanism for sharing knowledge and information by many organisations. A company newsletter is a regularly distributed publication sponsored by the company to provide information of interest to their employees. General attributes of newsletters include news and upcoming events of the related organisation, as well as contact information for general inquiries. Company newsletters are directly linked to the operations of the company. In this case, they are the chief sources of news and information for the whole team. In addition to providing content of genuine business value, the use of newsletters can be optimised by mixing up their content with the following:

- Case studies;
- News stories;
- Opinion articles;
- Product updates;
- Digests (*e.g.* of new construction materials);

- Educational articles;
- Editorials;
- Introduction of new employees or managers; and
- Social event reports.

According to Abbott (2001), a newsletter can function as more than just a routine communication tool. If the publication of a company newsletter is managed in line with the organisational mission, it can also serve a strategic function. A strategic newsletter can potentially be used by the company to reinforce or change the behaviour and attitude of its employees.

Lessons Learned Databases

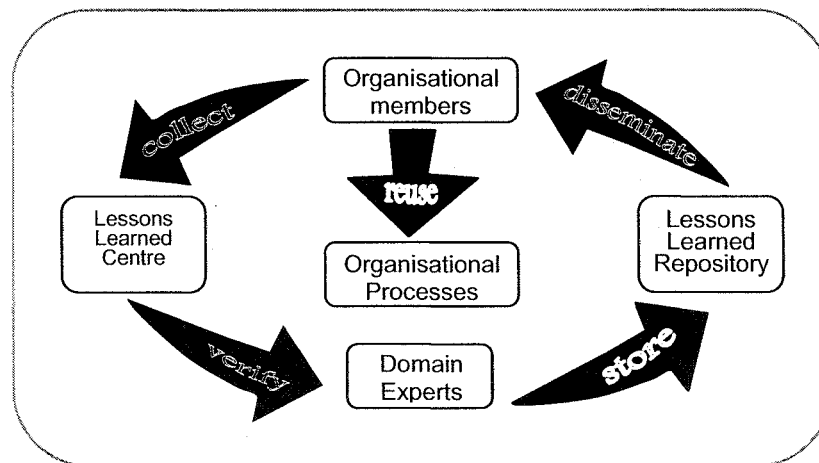
Knowledge gained from negative or positive experiences may be managed or even created by an organisation for use at different times in order to avoid making the same mistakes or repeat the same efforts twice. Organisations such as the US National Aeronautics and Space Administration [NASA], the European Space Agency [ESA], the National Space Development Agency of Japan [NASDA] and the Center for Army Lessons Learned [CALL] have been reported as being in the forefront in managing and creating lessons learned artefacts, although their use is said to be limited (Weber *et al.*, 2000a).

At the very basic level, lessons learned databases are often created by companies to catalogue past failures in an attempt to avoid similar situations when designing variant products (Darlington and Booker, 2005). Other authors such as Weber *et al.* (2000a) account that at the beginning, lessons learned were conceived of as merely artefacts containing guidelines, tips, or checklists of what went right or wrong in particular events. Today, this concept has evolved and the quality of the stored lessons learned knowledge has also improved, requiring a validation mechanism and an applicability test in the process of their creation or development. This is reflected in the definition of a lesson learned offered by Secchi *et al.* (1999) based on their studies with the American, European and Japanese space agencies:

“A lesson learned is knowledge or understanding gained by experience. The experience may be positive, as in a successful test or mission, or negative, as in a mishap or failure... A lesson learned must be significant in that it has a real or assumed impact on operations; valid in that it is factually and technically correct; and applicable in that it identifies a specific design, process, or decision that reduces or eliminates the potential for failures and mishaps, or reinforces a positive result” (p.57).

In a process-step model (see Figure 2.17), Weber *et al.* (2000a) illustrate how a lesson learned may be captured or created, stored in the databases and then reused.

Figure 2.17
Process-step development of lessons learned artefacts
(Adapted from Weber *et al.*, 2000a)



As depicted in the above model, the process of creating a lesson learned document or artefact involves the following tasks: *collecting*, *verifying*, *storing*, *disseminating*, and *reuse*. Weber *et al.* (2000a) identified five methods that may be performed in the *collection* stage.

- (1) *Passive collect*: Project teams may submit their own codified or narrated lessons.
- (2) *Reactive collect*: Lessons learned knowledge may be obtained through interviews with the subjects.
- (3) *After action collect*: Lessons learned knowledge may be generated through review mechanisms such as post project reviews.

- (4) *Active collect*: Lessons learned knowledge may be anticipated through a strategic planning exercise.
- (5) *Interactive collect*: Lessons learned knowledge may also be generated by using a dynamic intelligent elicitation system as reported by Rosina Weber and others in Weber *et al.* (2000b). The idea of an interactive collect mechanism is to facilitate real time interaction with the subjects.

In the *verification* stage, a team of experts will verify the lessons knowledge for correctness, redundancy, consistency and relevance. The *storing* stage addresses issues related to knowledge representation (*e.g.* level of abstraction) and indexing of lessons, formatting, and the repository's framework. Lesson representations may be structured, semi-structured, or in different media (*e.g.* text, video, audio). As for the *dissemination* process, again, Weber *et al.* (2000a) distinguish five possible methods:

- (1) *Passive dissemination*: Users may search for required lessons learned knowledge in a (usually) standalone retrieval tool.
- (2) *Active casting*: Lessons learned knowledge may be broadcast to potential users via a dedicated list server.
- (3) *Active dissemination*: Users may be pro-actively notified of relevant lessons (*e.g.* best practices).
- (4) *Proactive dissemination*: The system builds a model of the user's interface events to predict when to prompt with relevant lessons.
- (5) *Reactive dissemination*: When users realise they need additional knowledge, they can invoke a help system to obtain relevant lessons.

Weber *et al.* (2000a) also make different categories in the *reuse* mechanism, namely:

- (1) *Browsable recommendation*: The system displays a retrieved lesson's recommendation that the user is able to read and copy.
- (2) *Executable recommendation*: Users can optionally execute a retrieved lesson's recommendation.

- (3) *Learning recommendation*: New users can input alternative applications for the lesson.
- (4) *Outcome reuse*: Involves recoding the outcome of using a lesson, which can help to identify a lesson's utility.

Most lessons learned databases in current use are web-based, for example using Intranet technology or Lotus Notes. Weber *et al.* (2000a) also recommend the use of artificial intelligence techniques to enhance the above processes.

The need to manage lessons learned databases is of primary concern in construction companies. Disterer (2002) relates the situation in construction work associated with the loss of knowledge in the following way:

“[after the end of a project] in most cases, even the place where the documentation of a specific project is stored will be unknown... it will be hard to find out which employees worked on recently finished tasks, and where these employees are working now within the company – if at all” (p.513).

Disterer (2002) further reasons that because the existence of projects is temporary, at the completion of a project, normally there is no institution or corpus left from which the lessons learned knowledge gleaned from the project can be accessed. Lessons learned databases serve as a hub that can link project teams to past knowledge of previous projects.

Patrick Fong and Jimmy Yip (2006) believe that by installing lessons learned databases in construction, “professionals can learn from lessons from past projects and share their knowledge or experience to create new lessons learned” (p.29). According to Tim Kotnour (2000), a lesson learned database can facilitate organisational learning in two ways. First, “the process of developing a lessons learned [document] provides an opportunity for the project team to take reflective time to gain a full understanding of project results” *i.e.* by reiteration and reflection upon their fresh experiences. Second, “a lesson learned is a mechanism to document the learning to share with others” (p.396) or to be recalled back at another time.

Standardisation of Methods and Best Practices

The standardisation of methods has become a normal practice in the construction industry as well as in others. This is particularly true of companies that specialise in a particular type of product in a given geographical region (Bennett, 2000). To illustrate, John Bennett (2000) provides examples of companies who build skyscrapers in Chicago. He says that these companies “have developed simple, direct procedures and standards that enable them to construct high-rise buildings at a speed that makes it look as if they are growing organically from day by day” (p.180). The general idea of using standardisation of methods for construction works is particularly ancient. According to Albert L. Batik (1989: 3), and as also cited in Ngulube (2001: 159), the code of Hammurabi, which was developed over four thousand years ago, includes instructions for the manufacture of a brick, with specifications for “the clay, straw and water content”. Ngulube (2001) observes that “the development of standards over the years has varied from extracting technical standards [specifications], through to broadly defined conventions [rules] to most generalised guidelines [models]”. A company develops internal procedures and standards in two ways. Standards may be set by default – common good practices developed over time – thus becoming *de facto* procedure or standards (Bennett, 2000). Alternatively, a committee of experts may be set up to develop standards that may at a later date be published as a formal procedure or standard (Bennett, 2000). Standardisations of methods have proven their value irrespective of which characterisation they belong to. They create a professional environment of “best practice” procedures (Ngulube, 2001).

Alistair Gibb (2001) defines standardisation as “the extensive use of processes or procedures, products or components, in which there is regularity, repetition and a record of successful practice” (p.2). Standardisation of methods and procedures provide many benefits for construction companies. They reduce the need for new information to be produced and communicated, less need for new design work and materials required can be ordered early (Bennett, 2000: 180), thus resulting in a greater efficiency and increased predictability (CIRIA, 1999). Standardisations can also enhance quality (Dale and Oakland, 1994), shorten learning time on or off site, improve constructability and reduce marketing risks. Technical standardisation can enhance reliability (Rossman, 1967) and *de facto* procedures and standards can lead the company to gain competitive advantage (Grindley, 1995). Although Hanseth *et al.* (1996) seem worried about the

impact of standardisation on the innovation process, however, the majority of the related literature suggests that standards are not a hindrance to innovation and development of novel technologies (e.g. Bailetti and Callahan, 1995). Standardisation of methods can even imbue the spread of technological knowledge and learning. As Adler and Cole (1995) insist, standardisation is essential for organisational learning because it captures best practices and facilitates the diffusion of improvement ideas throughout the organisation.

2.8 Enabling Conditions for Organisational Learning

Choe (2002) states, “effective organisational learning is not automatically accomplished by the offering of information”. A company must provide the right conditions which enable organisational learning to take place. This thesis identifies three sub-constructs that can be regarded as enabling conditions, namely: (1) motivating factors, (2) learning culture, and (3) facilitating factors.

Motivating factors are an important element that encourages individuals to engage in voluntary or informal learning. Engleman and van de Ven (2002) define motivation as the conditions governing an individual’s direction, intensity and persistence of effort that is not due solely to differences in ability or to environmental demands that coerce or force action. Motivation requires well-designed reward and recognition systems. Employees must be rewarded for both performance and behaviour. Recognition schemes are powerful ways for the organisation to articulate the significance of knowledge development, sharing and reuse. Therefore, in order to motivate individual members to continuously learn and perform the kind of innovative behaviour (Katz, 1964), the company should (1) provide a *reward and recognition system* and (2) *value creative failures* that encourage learning by trying and promote risk taking.

The nature of learning and the way in which it occurs are determined by the organisation’s cultures. The second element that enables organisational learning is therefore related to culture. The basic assumption is that an organisation’s culture leads to learning values that produce a different learning style from a culture with another set of values. According to Kululanga *et al.* (2001), a successful culture of organisational learning can influence long-term effectiveness and survival. Daft (1992) defines

organisational culture as “the set of values, guiding beliefs, understandings, and ways of thinking, that is shared by members of an organisation and is taught to new members as correct”. The underlying assumption of this view maintains that in order to survive, organisations should attempt to maintain an internal culture that supports learning from experience (Schein, 1985). A learning culture is therefore a culture that fosters and nurtures learning. This thesis identifies five learning cultures commonly cited by many scholars. These are (1) *openness* – the belief that everyone should have access to open communications, (2) *freedom of speech* – the belief that employees should be free to express their aspirations, (3) *inquiry and dialogue* – the belief that the company should encourage an open exchange of ideas and knowledge, (4) *experimentation* – the belief that the company should encourage its members to take risks and innovate, and (5) *change* – the belief that change is inevitable and is necessary for learning and improvement.

The third enabler of organisational learning is related to formal structures that are institutionally established to facilitate learning. These are known as facilitating factors. In a broad sense, facilitating factors are “the structures and processes that determine how easy or hard it is for learning to occur and the amount of effective learning that takes place” (Nevis *et al.*, 1995). Numerous researchers have identified factors that are considered as facilitators to organisational learning (e.g. Hedberg, 1981; Pedler *et al.*, 1997; Goh and Richards, 1997); Nevis *et al.*, 1995). In synthesising the various contributions, this thesis discusses the six most important factors that function as facilitators to organisational learning. These are (1) *company policies* that reflect the value of all members, (2) *easy access to information*, (3) *supported personal development*, (4) *facilitated informal learning*, (5) *personal and team interaction*, and (6) *project team autonomy*.

By analysing the commonalities among the various descriptions found in the literature, the following thirteen *learning enablers* are identified. The author believes these set of enablers are the most important ones:

- (1) Provide incentives for learning
- (2) Value creative Errors
- (3) Provide a climate of openness
- (4) Promote freedom of speech
- (5) Foster inquiry and dialogue
- (6) Foster a spirit of innovation and experimentation
- (7) Embrace constructive change
- (8) Build a democracy at work through participative policy-making
- (9) Develop easy access to information
- (10) Support personal development of employees
- (11) Provide facilities for informal learning
- (12) Promote inter-personal and team interactions
- (13) Delegate autonomy to project teams

2.8.1 Enabler 1: Provide Incentive for Learning

The incentives system of a company influences how its employees learn. According to Pham and Swierczek (2006), a system which rewards innovation and knowledge contribution encourages more learning. Their study suggests the importance of incentives on the process and outcome of organisational learning. Scholars such as Argote and Eppe (1990) and O'Dell and Grayson (1998) insist that incentive systems should be in place to promote employees' motivation for taking the time to generate new knowledge or learning, share their knowledge and experience, and help others outside their own functions. Recognition and reward systems are suggested by Yeo (2006) as one of the overarching factors that can motivate and drive individuals to learn at work. For example, in Mulholland *et al.*'s (2000) study, they found some evidence of the use of incentives and rewards, even in a sharing culture. One of their test sites had an extensive incentive and reward scheme to promote the submission of best practice.

Rewarding and celebrating success means that employees within the organisation are challenged to develop their learning; thus the company provides "a condition that

reinforces learning for people in the company” (Pedler *et al.*, 1997: 115). This can be achieved in many ways such as an apprentice award scheme, employee of the year, a bottle of champagne, performance-related pay, royalties on ideas, bonuses, and so on. As suggested by Bartlett and Ghoshal (1998), one way to motivate the practice of sharing learning is to base rewards to groups on more than solely financial success. However, rewards based only on financial success tend to encourage competition and lack of sharing. According to Goh (2002), incentive systems and measurements that favour a more balanced scorecard that takes into account collaboration and the sharing of best practices can play a critical role in encouraging knowledge sharing. He conclusively suggests that rewards should be broadly based on other criteria such as successful knowledge sharing, cooperation and teamwork, rather than based on competition between groups in the organisation.

















2.8.2 Enabler 2: Value Creative Errors

An environment that is open to learning will tend to have a high tolerance for non-conformists. Kriegesmann *et al.*'s (2007) study suggests that a culturally exacerbated antipathy towards errors ultimately leads to a situation of pronounced innovation incompetence in which creative behaviour is avoided. They point out that it is not an ‘absolution of mistakes’ that is required, but a tolerance for legitimate errors, which should only occur under exceptional circumstances. The authors underline that fairness in dealing with errors is considerably more important than a misguided attempt to create or maintain harmony. However, it must distinguish between ‘creative errors’ and ‘normal failure’, which is closely related to a lack of concern. A creative error is an innovative initiative that is conducted with calculated risk. For example, it occurs when specialists and managers depart from familiar routines in a bold attempt at controlled experiments and by so doing undertake manageable and prudent risks (Kriegesmann *et al.*, 2007: 59). The authors identify eight types of errors that are likely to occur in organisations ranging from coincidence errors, which are not attributable to individual behaviour, to changing environmental conditions and stress, to outright carelessness and negligence (see *Table 2.18*).

An organisation that automatically punishes failure is likely to inhibit further explorations into the realm of organisational learning. Therefore, as an integral part of a risk taking culture, constructive errors and mistakes are tolerated and changed into

useful learning. A company that values creative errors not only discusses success stories, but also failures. A company that undermines creative errors often engages in a discussion of mistakes that results in punishment or sanctions against those identified as responsible following a search to lay the blame.

Table 2.18
Type of errors (adapted from Kriegesmann et al., 2007)

<i>Error type</i>	<i>Reason for failing to meet objective</i>	<i>Reaction to failure to meet objective</i>	
		<i>Tolerance</i>	<i>Sanction</i>
Sabotage	Deliberate errors (fraud, material damage, etc).		
Secret failure	Intentional concealment of error.		
Flop. Blunder	Carelessness, negligence, not bothering, overestimating own ability.		
Omissions	Failure to act as error, caused by overload or insufficient orientation and understanding.		
Repeat errors	Series of errors caused by inability or unwillingness to learn.		
Excessive demands	Mismatch between capabilities and responsibilities.		
System errors	Environmental dynamics/ changing circumstances.		
'Creative errors'	'Successful failure' with manageable and calculated risks through bad luck, coincidence or residual risk.		

2.8.3 Enabler 3: Provide a Climate of Openness

According to Argyris (1977), established norms can dangerously prevent employees from saying what they know about technical and policy issues in organisations. Studies have demonstrated that existing organisational norms can function as a kind of defensive routine (Argyris, 1990) that limit individuals to express their beliefs and opinions about organisational issues (Morrison and Milliken, 2000). A climate of openness functions as an enabler to organisational learning in the way that it provides a context for people in organisations to freely share ideas and information. Much learning in organisations is a function of daily, formal/informal and often unplanned interactions and communications among people (Nevis *et al.*, 1995).

Nevis and his associates provide a dramatic example of how openness is practiced in organisations. In a French Electric Company, they observed that abnormalities or deviations are publicly reported through the entire system of fifty-seven nuclear power plants. The company treats such incidents as researchable events to see if the problem exists anywhere else and follows up with a learning driven investigation to eliminate it. It then disseminates this knowledge throughout the company.

The presence of a climate of openness means that all members of the organisation have access to open communication, problems are shared, debate and conflicts are acceptable ways to solve problems (Appelbaum and Gallagher, 2000). A company lacking an open climate may have norms of false politeness that emphasise conformity, and may have developed a culture of suspicion and distrust that blocks communication and the flow of information. Listed below are some of the behaviours that typify a climate of openness:

- Freedom to experiment with new methods.
- Allowing free flow of information.
- Risk-taking and accommodation of diverging views.
- Using mistakes as part of a learning process.

2.8.4 Enabler 4: Promote Freedom of Speech

Haskins (1997) concludes that “free and responsible speech, vigorously encouraged and promoted as part of the organisational culture, offers the most productive solution for preparing organisational members to meet the challenges of the next century”. More specifically, Mitchell and Nicholas (2006) found that when individual members believe in freedom of expression and value the understanding and utilisation of diverse viewpoints, their groups engage in behaviours that are more effective in creating learning. In a survey study involving 12 companies, by Zarraga and Garcia-Falcon (2003) show that freedom of expression in the work team favours knowledge creation.

A commonly held view for freedom of speech reads “one simply says whatever he or she wants to say” (Haskins, 1997). Placed in a company context, this means that employees are free to express their aspirations and the company can provide mechanisms whereby people can convey their messages to management without fear. If

a company lacks freedom of speech, they may have a culture of fear where people are unwilling to express their views.

2.8.5 *Enabler 5: Foster Inquiry and Dialogue*

Watkins and Marsick (1999) consider inquiry and dialogue as one of seven action imperatives for learning organisations. In Senge's (1990) formulation of learning organisations, the discipline of team learning involves "mastering the practices of dialogue and discussion". Senge explains the difference between discussion and dialogue: "In dialogue, there is the free and creative exploration of complex and subtle issues, a deep 'listening' to one another and suspending of one's own views. By contrast, in discussion different views are presented and defended, and there is a search for the best view to support decisions that must be made at this time". However, dialogue and discussion are potentially complementary. Inquiry and dialogue enable learning in that during the process of dialogue, individuals learn how to think together. This is "not just in the sense of analysing a shared problem or creating new pieces of shared knowledge, but in the sense of occupying a collective sensibility, in which the thoughts, emotions and resulting actions belong not to one individual, but to all of them together" (Senge *et al.*, 1994). Isaacs (1993) defines dialogue as "a sustained, collective inquiry into the processes, assumptions and certainties that compose everyday experience. Yet this is an experience of a special kind, the experience of the meaning embodied in a community of people" (p.25). Dialogues thus have the potential to enable the sharing of tacit knowledge.

Fostering inquiry and dialogue means that the company encourages an open exchange of ideas and knowledge sharing through appreciative inquiry and dialogue. This will facilitate a multidisciplinary collaboration that inspires learning. A company that is unsupportive towards inquiry and dialogue does not invite challenge or inquiry for understanding.

2.8.6 Enabler 6: Foster a Spirit of Innovation and Experimentation

The process of finding, trying, and codifying new solutions springs from a culture that embraces innovation and experimentation (Vestal, 2004: 6). Goh (2002) proves that a strong culture of experimentation, together with others factors such as a collaborative and cooperative climate, have a positive influence on knowledge sharing. Experimentation requires a willingness and a boldness to question the status-quo. Implicit in Nevis *et al.*'s (1995) study is the suggestion that companies that emphasise the importance of experimentation on an ongoing basis learn more than those that do not: "the more one can plan guided experiences [*i.e.* experimentations], the more one will learn". They argue that unless managers see organising production as a learning experiment as well as a production activity, learning in such a company will come slow. "Managers need to act like applied research scientists at the same time they deliver goods and services" (p.80).

Garvin (1993) proposes two different experimentation activities to enable organisational learning: ongoing programmes and one-of-a-kind demonstration projects. Ongoing programmes involve a continuing series of small experiments, designed to produce incremental gains in knowledge. They are the mainstay of most continuous improvement programmes and are especially common on the operative level. In contrast to ongoing experiments, demonstration projects are usually larger and more complex. They involve holistic, system-wide changes, introduced at a single site, and are often undertaken with the goal of developing new organisational capabilities (pp.82–83).

Fostering a spirit of innovation and experimentation means that the company should take creative steps to "encourage as many people as possible [within the organisation] to take risks and innovate and to get out of the habit of asking permission and waiting for instructions" (Pedler *et al.*, 1997: 118). Individuals are free to take risks, experiment, innovate, explore new ideas, and generate new work processes and products. Employees in a company that negates the drive of innovation and experimentation fear to experiment with something new and prefer to play safe. Such a company does not encourage people to take initiative in their work.

2.8.7 *Enabler 7: Embrace Constructive Change*

Change is a constant in the workplace. Organisational culture has often been construed as a source of resistance (Schein, 1985) or source of defensive routine (Argyris, 1991) to learning and change. Organisational learning, in Mahler's (1997) definition, is the capacity of organisations to change themselves in response to experience. In this view, learning is thought to be an especially informed and effective type of change because it represents a conscious effort to interpret and analyse results in order to correct problems rather than just a blind reaction to crises. Constructive change, hence, enables organisational learning and vice versa.

In a company that fosters constructive change, their managers are encouraged to take a lead in initiating learning and their employees are motivated to learn new ways of doing things. This means that the company's alignment to change and the adoption or implementation of new initiatives is supported by all employees. Everyone in the company is prepared to change the way they work. In a company that does not embrace change, its members tend to maintain old beliefs, which lead to conservative behaviour and an unwillingness to experiment with new ideas. Such a company undergoes change only as a reaction to external events.

2.8.8 *Enabler 8: Build a Democracy at Work*

Building a democracy at work is one of the important factors to enable organisational learning. Among other things, this can primarily be achieved through participative policy making activities. Tuler (1998) believes that organisational learning occurs when people collectively learn and incorporate those lessons into how they do things on a macro scale (across multiple units, groups and individuals). Associated with substantive learning are, according to this author, the skills and practices related to how people do things, which include skills of problem solving, skills of argumentation, processes for doing 'good' social involvement and collaborative decision-making. Following these arguments, he identified four different types of learning in deliberative policy making processes which, according to the author, can be used as a practical guidance on how each organisation level might learn by participating in policy making activities (see *Table 2.19*).

A democratic company means that all members of the organisation are involved in the policy-making process by which they “have a chance to contribute to and debate major policy decisions” (Pedler *et al.*, 1999: 79). There is a deliberate fostering and encouragement of contributions and recognition that successful debate involves working with tensions, or even conflicts, between different views and values. A company that has no appropriate democracy at work often centralises the development of company policies and then expects employees to comply with those policies.

The following are some of the characteristics that identify a democratic company (Diez *et al.*, 2005):

- All individuals and groups have the right to participate in the policy making process.
- Diversity is valuable, since it increases creativity, ideas and innovative solutions.
- The efforts made to satisfy all the groups involved in the company must achieve higher quality in response to the high demands of the market and an internal climate of learning.

Table 2.19
Types of learning in deliberative policy making processes

<i>Who Learn</i>	<i>What is Learned</i>	
	<i>Substantive</i>	<i>Interactional</i>
Individual	What is my opponent's interpretation of the data?	How can I make a forceful argument for my perspectives?
Group	What are the primary values guiding our vision?	How can members be motivated to participate?
Organisational	What are the interests and values of different stakeholders that ought to inform this policy decision?	What are the best ways to structure meetings for gathering and evaluating all relevant information?
Societal	What are the implications of these issues?	What are the lessons for designing processes for shared decision making in other policy arenas?

2.8.9 Enabler 9: Develop an Easy Access to Information

The statement that easy access to information enables learning is not just a slogan. This is true because learning in itself involves the processing of information (Huber, 1991). The information processing can involve acquiring, distributing or interpreting information. Huber (1991) assumes that “an organisation learns if any of its units acquires knowledge that is recognised as potentially useful to the organisation”. To allow this process to occur more frequently, the organisation should provide infrastructures to ensure that information is available and easily accessible to all members. A wider distribution of information promotes more widespread and more frequent learning. Goh (2002) suggests that information technology systems must be available in order to facilitate the flow of information and make it easily accessible. In addition, in order to support learning at all levels, a company should facilitate information distribution and transfer by channelling it to those who need it. Information and information technology are thus the input that enables the organisation to process learning, which in turn produces new knowledge and understanding and therefore modify its actions.

Easy access to information means that the company “provides people with access to all relevant information held by the company to speed action, create public domain databases which speed information flow to the point in the organisation, ...and are designed to encourage learning” (Pedler *et al.*, 1997: 92). Facilities that can foster public access to information include Intranets, email, bulletin boards and a space for informal meetings. In a company that is not supportive to learning, there are few opportunities or resources available for the widespread public sharing of information. Pedler *et al.*, (1997) note that the use of information technology is to inform and empower people rather than disempower them. Therefore, it must primarily be directed to (Diez *et al.*, 2005; Pedler *et al.*, 1997):

- Provide all employees with the greatest possible access to information;
- Empower people to understand the systems and processes of the company;
- Reveal the systems and their influence on results;
- Investigate the special causes that can lead to out of control situations; but
- Not to punish or have control over the people.

2.8.10 Enabler 10: Support Personal Development

A learning company aims at motivating and facilitating its employees to engage in various learning activities. In such a company, employees are encouraged to continually develop, learn and acquire new knowledge as this is seen as a way of being dynamic and coping with change; however, it is also to make work more rewarding and stimulating for employees (Symon, 2002). Opportunities are provided to all members of the organisation to become involved in development activities, such as career orientations, workshops, seminars, self-learning materials, development groups, instructors, mentors, professional advisors and company reading rooms.

A supported personal development means that the company frees employees from managing their own development by providing opportunities, resources and guidance. A company's career planning is aligned with individuals' learning needs. Employees are also encouraged to take responsibility for decisions that directly affect their work. A company that is not supportive toward individual learning lacks the budget or resources for personal development. If the company were to train employees, they may not consider employee's career aspirations and learning interests.

2.8.11 Enabler 11: Facilitate Informal Learning

According to Laiken (2003), in the learning organisation the central context for knowledge enhancement and skill development is shifting from the more formal environment of classroom training to the more informal learning environment of the workplace itself. The teachers are colleagues and managers who are engaged with each other in action learning, or extracting the learning from the immediate work challenges. The author maintains that what makes the learning organisation unique is its conscious intention to legitimise and create space for such informal learning, through:

- Helping to establish supportive, mentoring relationships in which the mentor acts as coach, or peer partners act as coaches for one another. The activities may involve job shadowing, help in reflecting on problems or mistakes to extract learning, and the provision of resources or guidance; informing communities of practice which enable informal dialogues on work-related issues.

- Providing skill development, either through action learning or classroom training, will provide the process-oriented and facilitative skills necessary to support reflective practice. These include the ability to help a team debrief its work and extract learning related to its functioning; the ability to use dialogic approaches in informal group explorations, the ability to individually reflect on one's experience in order to reach conclusions which can then be tested in action; and the interpersonal skills required to check assumptions, explore differing world views and learn from others through genuine, open interaction.
- Developing a shared set of values which reinforce and make public the organisation's commitment to creating an environment for learning, as outlined in the three preceding points (Laiken, 2003).

A successful learning company provides sufficient resource systems to support informal learning, such as libraries, learning centres, space for informal chatting and the exchange of stories. A non learning company does not sufficiently encourage informal learning, or tends to attach it to tangible organisational incentives. Time spent in informal learning is viewed as time being taken away from real work.

2.8.12 Enabler 12: Promote Inter-personal and Team Interactions

Companies of today are increasingly relying on distributed teams and interpersonal networks. This is particularly relevant to the construction industry where works are based on temporary project teams from different organisations. Team interactions enable learning in a way that their interactions lead to the development of implicit and explicit rules that regulate team member behaviour in achieving their goals and functions (Walton and Hackman, 1986). Grant (1996) similarly suggests that interpersonal networks and teams create coordination mechanisms in the form of formal or informal procedures or norms in order to economise on communication, information transfer and knowledge sharing, thus reserving team decision making and problem solving for complex and unusual tasks. This process implies that individuals, networks, groups, teams, communities of practices, departments and divisions exchange information on expectations, and give feedback on goods and services received (Pedler *et al.*, 1997: 106). This will inherently lead to the setting of norms of trustworthy

behaviour. A company that does not promote inter-personal and team interactions may have a culture of suspicion. Hierarchy and status may also restrict the free flow of ideas and information.

2.8.13 Enabler 13: Delegate Autonomy to Project Teams

Autonomy is considered to be a central prerequisite for organisational learning to occur (Nonaka and Takeuchi, 1995). Autonomy affords team members the freedom to pursue new knowledge that may ultimately translate into a shared team conception. Therefore, in order to enable learning, project teams should be given some degree of freedom to perform tasks according to their own knowledge and experience. This has been supported by Mulholland *et al.*'s (2005) study, which demonstrates the link between continuous learning and group autonomy.

Sufficient authority and flexibility should be given to project teams on site to act and adapt their working strategies as needed, without long procedural formalities that can slow down the project delivery. Project teams should also be given adequate space to govern their learning strategies. A company that is not willing to delegate some autonomy restricts the freedom of project teams to alter and adapt their task execution on site, which in effect impedes any opportunity to innovate and improve their practices.

2.9 The Limits of Organisational Learning

There are several limits to what organisational learning can offer organisations, three of which are discussed in this thesis: (1) organisational learning does not always lead to better performance, (2) organisational learning can drive organisations into *competency traps*, and (3) true *organisational learning is difficult* to realise due to its inherent constraints.

2.9.1 Organisational Learning and Performance

The general premise assumes that organisational learning positively improves performance (Tsang, 1997). Supportive evidence of this relationship derives from various settings. Research has shown performance benefits of learning from experience as demonstrated by learning curves (Epple *et al.*, 1991). However, the fact is that organisational learning does not always improve performance (Cook and Yanow, 1993; Huber, 1991). Tsang (1997) argues that organisational learning will automatically lead to better performance only when the knowledge obtained is accurate. However, according to this author, if the problem of implementation is taken into consideration as well, even accurate learning is neither a necessary nor a sufficient condition for improving performance because incorrect learning may also result in greater organisational effectiveness due to sheer luck (p.78).

2.9.2 Competency Traps

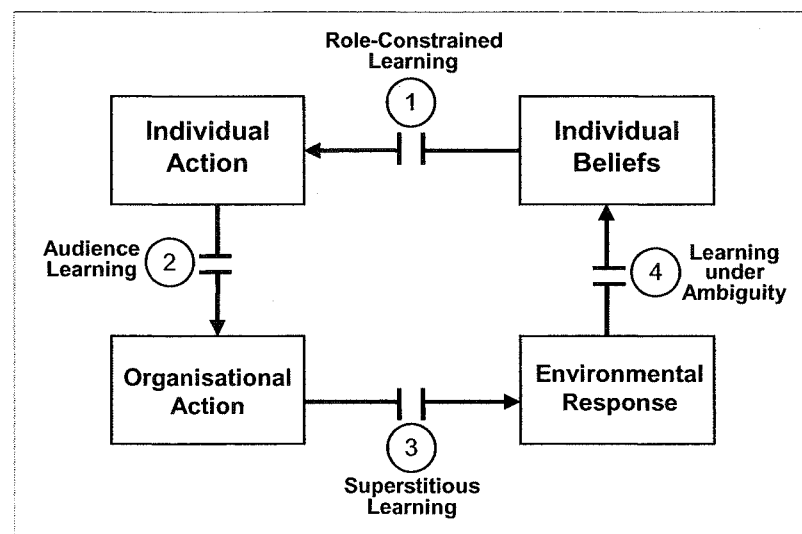
Excessive single-loop learning can throw organisations into a dangerous zone called the competency trap (Levitt and March, 1988 Levinthal and March, 1993). The competency trap concerns the propensity of a company to continue relying on processes that have been successful in the past even though they are no longer optimal. “[A] competency trap can occur when favourable performance with an inferior procedure leads an organisation to accumulate more experience with it, thus keeping experience with a superior procedure inadequate to make it rewarding to use” (Levitt and March, 1988: 322). Since it takes time to develop competencies through repetitive work or routines, it is likely that with increased age the probability of changing or altering a routine declines.

According to Liu (2006), the formation of a competency trap resulting from imbalanced knowledge exploitation and knowledge exploration derives from a range of factors, including the pursuit of efficiency, limited rationality, path-dependent factors and adaptive dynamics. The competency trap is a potentially self-destructive product of organisational learning. However, it is not inevitable. An important measure which can guard against falling into the competency trap is to maintain the balance between knowledge exploitation and knowledge exploration activities and to remain aware of their environment (Levintal and March, 1993).

2.9.3 *The Difficulties of Organisational Learning*

Many scholars such as March and Olsen (1975), Levitt and March (1988), March (1991) and others have discussed some difficulties and dilemmas associated with the intrinsic nature of organisational learning. The most systematic discussion of learning difficulties was offered by March and Olsen (1975) at a time when the organisational learning concept was still in its premature state. Using a model of learning process (see *Figure 2.10*) that highlights the linkage between individual beliefs, individual action, organisational action and environmental response, March and Olsen (1975) identified four types of interruption to the learning cycle (see *Figure 2.18*).

Figure 2.18
The incomplete learning cycles (Adapted from March and Olsen, 1975)



The first difficulty is what is called “*Role-Constrained Learning*” (March and Olsen, 1975: 158). With regard to this difficulty, March and Olsen theorised that an interruption in the connection between individual beliefs and individual actions would result if individuals were limited by their role in the organisation and unable to act on their learning.

The second interruption to the learning cycle is called “*Audience Learning*” (March and Olsen, 1975: 159). An audience learning can be found when individuals change their own behaviour but the effect of these actions on the organisational behaviour and action is ambiguity. In such a case, individual learning and skill development takes place, but adaptation by the organisational environment does not necessarily follow.

The third phenomenon that results from incomplete learning is called “*Superstitious Learning*” (March and Olsen, 1975: 158; see also in Levitt and March (1988). Superstitious learning is found when organisational members draw incorrect conclusions with regard to the impact of organisational actions on the environment. Levitt and March (1988) state that “superstitious learning occurs when the subjective experience of learning is compelling, but the connections between actions and outcomes are mis-specified” (Levitt and March, 1988: 325).

The fourth disruption to learning is termed “*Learning under Ambiguity*” (March and Olsen, 1975: 156) and occurs when reasons for changes in the environment cannot be clearly identified; the linkage between the environmental response and individual learning is interrupted.

2.10 Chapter Conclusions

This chapter has provided the general concepts and models associated with organisational learning. The main constructs relating to the research topic have been identified and outlined. Additionally, various learning mechanisms and thirteen sets of learning enablers have been examined that set the preconditions for organisational learning competence. A short discussion on the limits of organisational learning concludes the chapter.

Drawing on this literature review, the next chapter develops a conceptual framework and establishes some hypotheses that will guide the research journey.

3. Conceptual Framework and Hypotheses

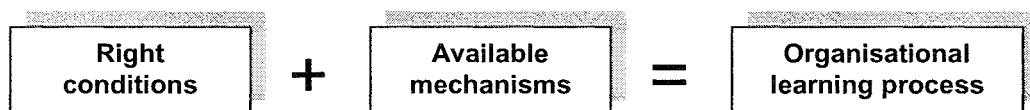
Every theory is a self-fulfilling prophecy that orders experience into the framework it provides.

-Ruth Hubbard (1979)

In the preceding chapter, the theoretical perspectives on organisational learning concepts were presented. Various models and constructs relating to the main elements of the current research were identified and outlined. Building on these rich theoretical perspectives, the purpose of the present chapter is to develop a research framework for evaluating the practice of organisational learning in construction companies.

As a starting point, this thesis embraces the notion of ‘organisational learning systems’ put forward by Kim (1993) and Nevis *et al.* (1995). It was noted in Chapter 1 (Section 1.3.2) that “organisations, when viewed as learning systems, differ in their ability to learn” (Coates, 1994). Nevertheless, as stated by Shrivastava (1983) and Nevis *et al.* (1995), all learning systems are identifiable from their three key elements: organisational processes, learning mechanisms, and enabling conditions. The rational implication of this perspective dictates that effective organisational learning depends on the provision of learning mechanisms and enabling conditions (see *Figure 3.1*). An organisation’s members are likely to engage in active learning when the organisation provides the right conditions for them to exercise their learning efforts. Moreover, a set of learning mechanisms is also required in order to facilitate and to channel the employee’s effort in knowledge capture and knowledge sharing. It is on the basis of this basic theoretical formulation that the present study has been developed. The aim is to test this proposition regarding the practice of organisational learning by construction companies.

Figure 3.1
Organisational learning requirements



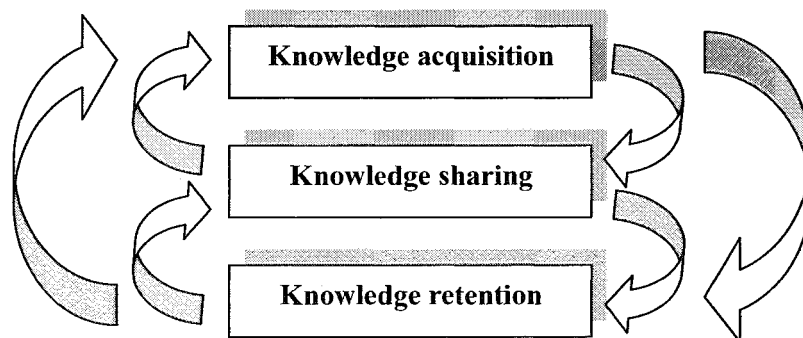
3.1 Organisational Learning System and Its Elements

The literature review revealed a great deal of interest in organisational learning since the publication of Argyris and Schon's (1978) ground breaking book '*Organisational Learning: A Theory of Action Perspective*' nearly thirty years ago. A growing body of literature has since evolved in different directions (refer to Chapter 2). However, it is generally agreed that the dynamics of learning in organisations can be depicted as a cyclical pattern involving three learning processes (see Section 2.6; cf. Zollo and Winter, 2002), namely:

- (1) *Knowledge acquisition* – the process of acquiring or developing knowledge from internal and/or external sources;
- (2) *Knowledge sharing* – the process of learning by which knowledge is spread or communicated among the members of the organisation through formal and/or informal mechanisms; and
- (3) *Knowledge retention* – the process of retaining organisational knowledge and experiences through either the development of human capacity (personalisation strategy) and/or by using technology-based memory systems (codification strategy).

These three learning processes or dimensions can be viewed as sequential, that is, knowledge is first acquired, and then distributed, and finally stored. However, this thesis concurs with Dixon (1992) who analyses organisational learning processes as continuous and interactive rather than sequential and independent, as represented in *Figure 3.2*.

Figure 3.2
Organisational learning as a continuous and interactive process



Although the use of terminology may differ from one theorist to another, the defined processes of organisational learning as depicted in *Figure 3.2* are mostly similar (see for example Huber (1991), Nevis *et al.* (1995) and Zollo and Winter (2002) for a comparison). In particular, there is a high degree of congruence between this model and the model of 'organisational learning as knowledge creation' presented by Nonaka (1991). According to Nonaka (1991), successful companies are those that consistently (1) *create* new knowledge, (2) *disseminate* it widely throughout the organisation, and (3) *embody* it quickly in new technologies and products. Each element of the presented model is described in detail in the following Sections 3.1.1 to 3.1.3.

3.1.1 Knowledge Acquisition

Organisations gain knowledge either through the internal experiences of their own employees or through the acquisition of external knowledge relevant to the organisation. Hence, the first process of the learning cycle involves either the creation or acquisition of knowledge. Likewise, organisations may develop core competencies through the means of exploitation or exploration (March, 1991). Exploitation is the use and further development of existing organisational knowledge and exploration is the pursuit of new (externally generated) knowledge (March, 1991). Sitkin *et al.* (1994) define exploitation as learning activities involving the use of resources the company has, and exploration as learning activities that lead to the addition of resources. These definitions essentially mirror the two different modes of learning, namely internal and external learning, which affect what kind of knowledge is produced and also reflect different inclinations, and the resulting implications for performance (Liu, 2006).

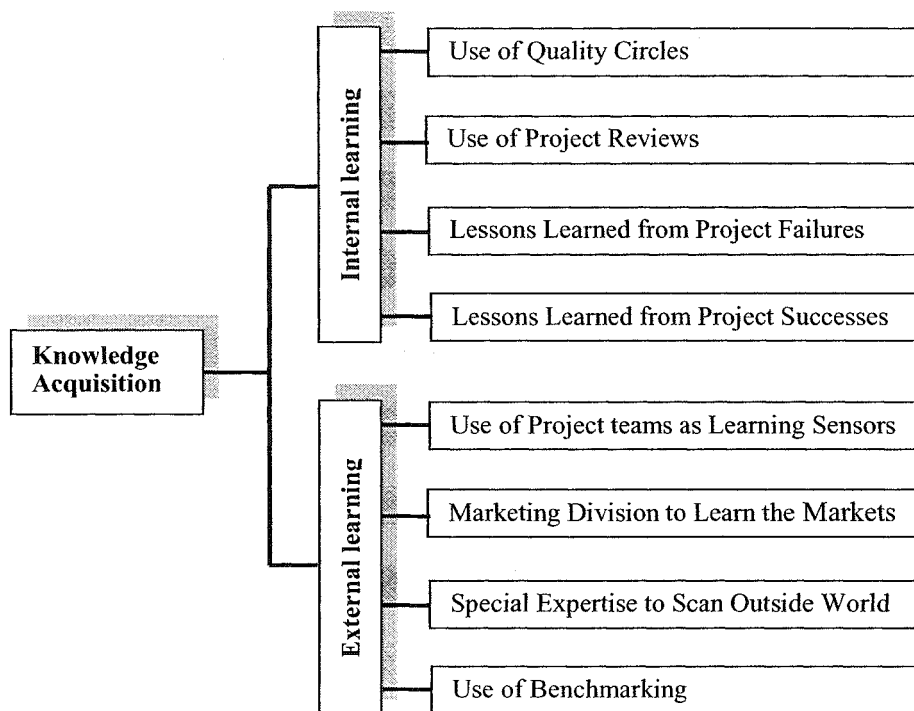
The concept of exploitation and exploration is also parallel with the 'knowledge sourcing concept' (DiBella *et al.*, 1996), which distinguishes between knowledge sourced internally (internal learning) and knowledge procured externally (external learning). Dixon (1992) claims that internal learning may be acquired through learning from company's own experience (learning by doing), learning by implementing continuous process improvement, and learning by attending to feedback and review mechanisms. Drawing from the learning mechanisms established in Chapter 2 (Section 2.7.1), learning from own experience can be facilitated through (1) the *use of lessons learned from project failures* and (2) *lessons learned from project successes*. Learning by implementing continuous improvement can be achieved through (3) the *use of*

quality circles, whilst learning by attending to feedback and review mechanisms is attainable through (4) the *use of project reviews*.

Dixon (1992) also writes that external learning may be generated by (a) *searching* – monitoring market and environmental conditions; (b) *borrowing* – using the knowledge sourced by other organisations on behalf of the company; and (c) *collecting or comparing* – that is, systematically collecting data on competitors' performance in order to compare it with company's own performance. With reference to Section 2.7.2, learning by searching is attainable predominantly through mechanisms such as (1) the *use of project teams as learning sensors* and (2) *the use of the marketing division to learn the market*. Learning by borrowing is enacted through (3) the *use of special expertise to scan the outside world*. Eventually, learning by collecting or comparing is practised by (4) the *use of benchmarking*.

Figure 3.3 illustrates how these learning mechanisms contribute to the knowledge acquisition process, as indicated above.

Figure 3.3
Knowledge acquisition model



3.1.2 Knowledge Sharing

Knowledge created or captured by individual members of an organisation must then be shared or spread throughout the organisation in order to become organisational knowledge. The second process of the organisational learning cycle therefore involves the spread or distribution of knowledge within an organisation.

Knowledge is distributed in organisations through a variety of ways or channels. However, DiBella *et al.* (1996) found that organisations predominantly exercise two different approaches to knowledge sharing. Companies that exercise the *formal approach* formally establish a policy in which it is decided a valuable insight or method is to be shared and used by others on a broad, institutionalised basis. Various mechanistic tools or technologies to support formal communications and institutionalised or standardised practices are generally employed for this purpose. The formal approach to knowledge sharing tends to be more mechanistic in nature and it emphasises facilitating ‘people to document’ communication.

In contrast, the *informal approach* to knowledge sharing mechanisms emphasises facilitating interaction between ‘people to people’ rather than ‘people to document’. In the informal approach, learning is spread through encounters between employees, for example due to their having similar tasks or interests. Another version of the informal approach is the kind of sharing of knowledge that occurs through social and casual interactions among employees, such as through informal gatherings or personal networking. The informal approach presumes that the spread of knowledge is best attainable through socialisation and so social and casual interactions among an organisation’s members are highly supported and facilitated.

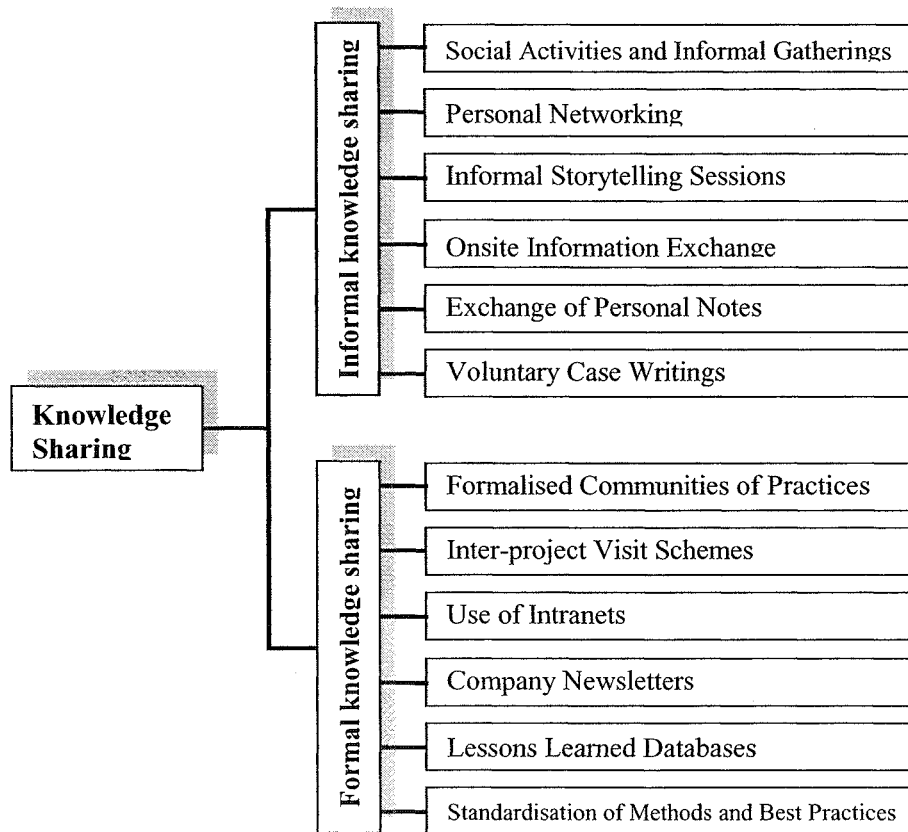
As described in Section 2.7.3, this thesis identifies six informal mechanisms that are likely to be used by construction companies to spread learning. (1) *Social activities and informal gatherings* – knowledge sharing typically occurs in an unintentional way when people meet and interact with each other within a social context. (2) *Personal networking* – knowledge sharing occurs through individual-based personal relationships. (3) *Informal storytelling sessions* – people voluntarily meet and share stories about their work in a casual or informal way. (4) *Onsite informal exchange* – the practice of sharing or exchanging information between parties on the site of a construction project. (5) *Exchange of personal notes* – it is common to exchange

personal notes among project members, for example notes taken during a project meeting. (6) *Personal case writings* – a case voluntarily written by project members about their personal experience of their project or task, which may be shared and recovered at the project review meetings in order to take advantage of the lessons learned.

The formal approach to knowledge sharing underlines the principle of centralisation and standardisation to achieve efficiency. The formal learning mechanisms are therefore characterised by their *formality* in that they are established and endorsed by the central organisation; and *structured* in that they are predefined and embedded in various organisational routines and structures (Boh, 2007). As delineated in Chapter 2 (Section 2.7.4), six formal mechanisms that are common to construction companies are: (1) *Formalised communities of practice* – to encourage and facilitate people to network within their community of specialisation; (2) *Inter-project visit schemes* – to allow project teams working on different sites to learn and share their experiences in addressing common problems; (3) *Use of intranets* – to provide an intra-organisational network to facilitate the sharing of information to all members; (4) *Company newsletters* – these are sponsored by the company to provide up-to-date information of interest to their employees; (5) *Lessons learned databases* – to provide a medium for some codified knowledge to be shared with others by storing it in public databases; and (6) *Standardisation of methods and best practices* – to provide a mechanism for sharing good practices within the company.

Figure 3.4 illustrates how these formal and informal learning mechanisms contribute to the knowledge sharing process, as discussed above.

Figure 3.4
Knowledge sharing model



3.1.3 Knowledge Retention

Knowledge may be generated and disseminated throughout an organisation, but unless it is stored in certain retention mechanisms then the learning cycle remains incomplete. The knowledge retention process represents the ultimate loci for analysing the organisational learning cycle.

Hansen *et al.* (1999) found that companies employ two very different strategies for knowledge retention. In some companies, the strategy centres on human development. Learning is thought of as a social process that chiefly occurs during the interaction between employees. Knowledge is closely tied to, and resides in, the person who developed it, and it is shared mainly through formal or informal interactions. Hansen and his associates call this a *personalisation strategy*. In other companies, learning is conceptualised as knowledge flows. Knowledge can therefore be separated from the individuals who developed it. Knowledge is carefully codified and stored in databases,

where it can be accessed and used easily by anyone in the organisation. Hansen *et al.* (1999) call this a *codification strategy*.

There are various mechanisms by which knowledge is retained in a codified form. In conjunction with the knowledge sharing mechanisms discussed in Sections 3.1.2, an individual's experience with a particular project may be retained in the form of (1) *personal case writing*; project teams may also develop some (2) *codified information* in various forms such as official documents (schedules, contracts, *etc.*), drawings, and symbols or codes. Due to the limitations of human memory, (3) *personal notes* are commonly used by employees to record important facts, actions, ideas, and decisions. In many organisations, (4) a *company newsletter* serves as a knowledge repository that can (re)tell about what happened at a particular time in the past. Knowledge gained from experience may be stored in (5) the *company databases* for future use. Probably the most significant form of codified knowledge is (6) *standardised methods or best practices* as a by-product of ongoing re-codifications and refinements.

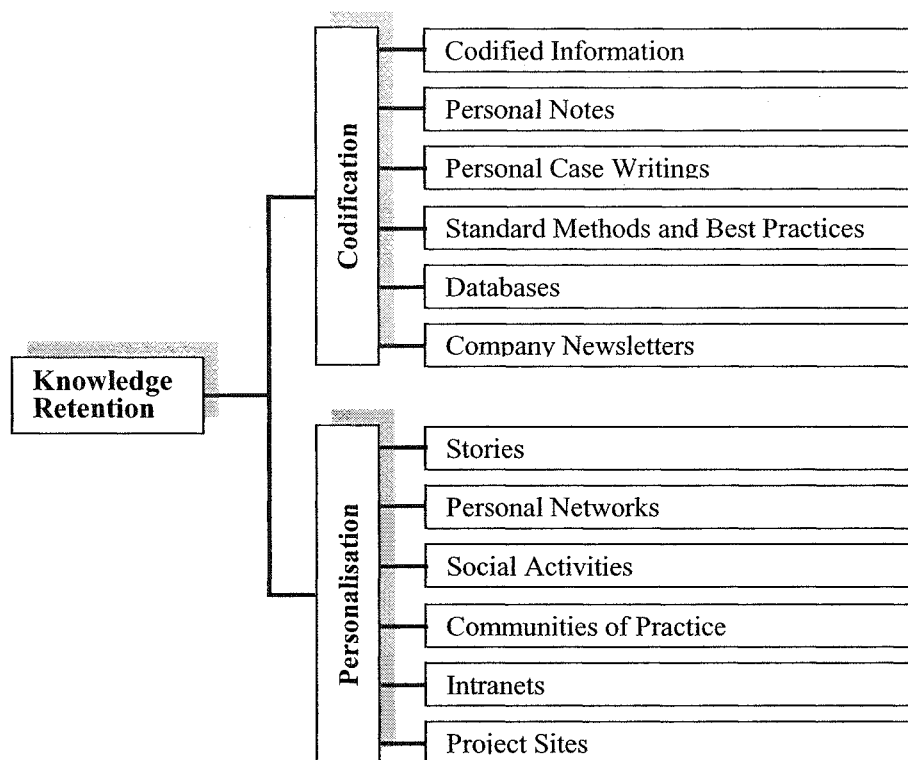
A personalisation strategy is built upon a belief that people are perhaps the most effective means for storing an organisation's experience (Simon, 1991). Olivera (2000) states that individuals, in the process of undertaking their work, generate knowledge that largely remains in their heads. Moreover, he argues that although no one particular member of an organisation is likely to be the sole repository of an organisation's memory, *networks* of individuals can be a powerful means of storage and retrieval of the organisation's experiential knowledge.

There are various forms of social network that can play important roles in storing knowledge about the organisation's experience and allow individuals to locate and access this knowledge (Olivera, 2000). In line with the knowledge sharing mechanisms described in Section 3.1.2, this section identifies six different networks that function as organisational memories and which are likely to be used by construction companies. (1) *Social activities and informal gatherings* – these can play an important role with respect to collective awareness. (2) *Personal networks* that are developed based on the principles of reciprocities are said to be a long-life memory system that will remain active even if their formal ties have resolved (Bonifacio *et al.*, 2002; Grabher and Maintz, 2006). (3) *Stories* are a powerful memory system that can hold both information and emotion, both explicit knowledge and tacit knowledge, and both the core and the

context (Ruggles, 2002). (4) *Communities of practice* have been widely discussed as a powerful form of knowledge repository due to their capacity to contain tacit knowledge and tradecraft that can be understood only through conversations with knowledgeable practitioners within their community. (5) *Project sites* may hold some contextual knowledge about particular events or processes that can be shared only through conversation with people involved in the project. (6) *Intranets* have dual functions as a means for storing knowledge as well as a means for communicating knowledge.

Figure 3.5 depicts how these different repository systems contribute to the knowledge retention process, as highlighted above, based on either personalisation or codification strategies.

Figure 3.5
Knowledge retention model



3.1.4 *Measuring Organisational Learning Competence*

Effective organisational learning is not automatically accomplished simply by providing information (Choe, 2002). A company must provide the right conditions to enable the organisation's members to engage actively in various learning activities as part of their work processes. Certainly, the presence of enabling conditions determines the efficiency and effectiveness of the organisational learning processes. However, they do not guarantee that useful learning will occur within an organisation, but if they are lacking, it is almost certain that the ability of the organisation to adapt to its environment will be severely hampered.

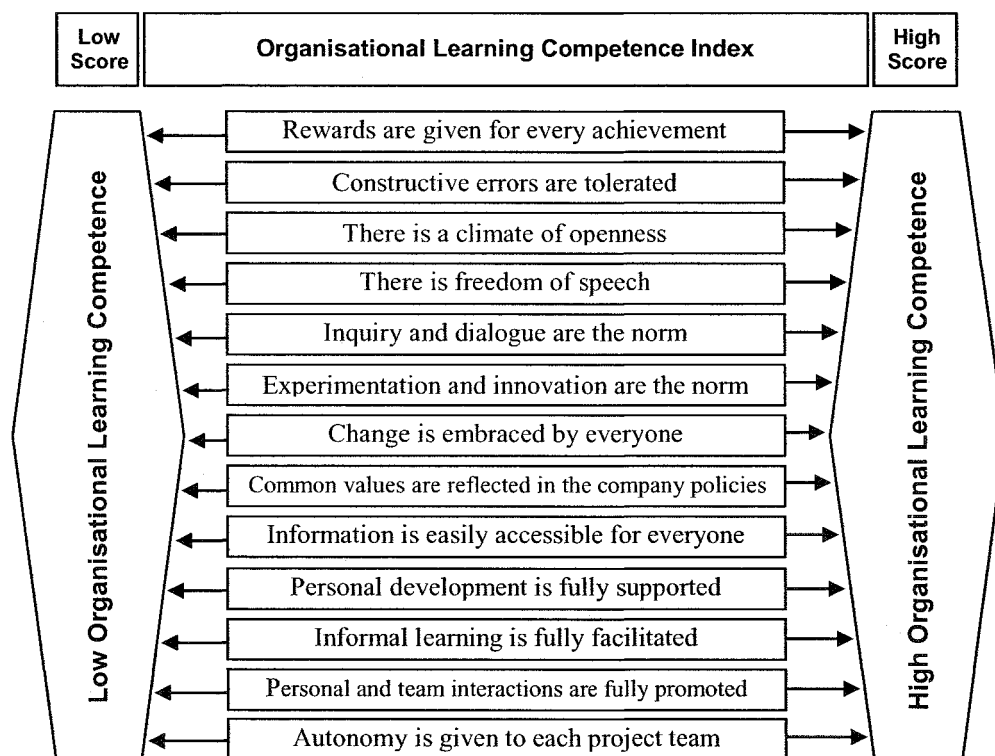
Drawing on the theoretical perspectives developed in Chapter 2 and especially Section 2.8, the view can be held that in order to support organisational learning, managers need to put in place a set of *learning enablers* – the overall set of organisational activities that positively affect knowledge creation and knowledge sharing (Von Krogh *et al.*, 2000). The 13 learning-enabling initiatives as identified in Chapter 2 are:

- (1) Provide incentives for learning
- (2) Value creative errors
- (3) Provide a climate of openness
- (4) Promote freedom of speech
- (5) Foster inquiry and dialogue
- (6) Foster a spirit of experimentation and innovation
- (7) Embrace constructive change
- (8) Build a democracy at work through participative policy-making
- (9) Develop an easy access to information
- (10) Support personal development of employees
- (11) Provide facilities for informal learning
- (12) Promote inter-personal and team interactions
- (13) Delegate autonomy to project teams

Individually, each of the above enablers can have a different effect on individual learning behaviour. Together, they reflect the ultimate idealistic capacity for an organisation to learn, which is referred to here as 'organisational learning competence' (Ozorhon *et al.*, 2005). Learning competence underpins the effectiveness of

organisational action and enhances the prospect of superior performance (Dunphy *et al.*, 1997). A company is assumed to have high organisational learning competence – referred to as the *HIGH LEARNING COMPANY* – if it has a great extent of association with the above organisational activities. Equally, a low organisational learning competence – referred to as the *LOW LEARNING COMPANY* – means that the company exhibits less correlation with these criteria. *Figure 3.6* illustrates how the extent of organisational learning competence may be assessed.

Figure 3.6
Measuring the extent of organisational learning competence



In order to provide a measure for assessing the organisational learning competence of construction companies, the following description of each of the competence criteria may be considered.

Rewards are given for every achievement

Rewarding and celebrating success means that employees within the organisation are challenged to develop their learning; thus, the company provides “a condition that

reinforces learning for people in the company” (Pedler *et al.*, 1997: 115). This can be achieved in many ways such as an apprentice award scheme, employee of the year, a bottle of champagne, performance-related pay, royalties on ideas, bonuses, and so on.

Constructive errors are tolerated

As an integral part of a risk-taking culture, constructive errors and mistakes are tolerated and changed into useful learning. Companies that score highly on this item not only discuss successes, but also failures. Companies that score low often engage in a discussion of mistakes that results in punishment or sanctions against those identified as responsible after a search for someone to blame.

There is a climate of openness

This means that all members of the organisation have access to open communication, problems are shared, debate and conflict are acceptable ways to solve problems (Appelbaum and Gallagher, 2000). Companies that score low on this item may have norms of false politeness that emphasise conformity, and may have developed a culture of suspicion and distrust that blocks communication and the flow of information.

There is freedom of speech

This means that employees are free to express their aspirations and the company provides mechanisms whereby people can convey their messages to management without fear. Companies that score low on this area may have a culture of fear and people therefore may be unwilling to express their views.

Inquiry and dialogue are the norm

This means that the company encourages an open exchange of ideas and knowledge sharing through appreciative inquiry and dialogue. This will facilitate a multidisciplinary collaboration that inspires learning. Companies that score low on this item do not invite challenge or inquiry for understanding.

Experimentation and innovation are the norm

This means that the company “has taken creative steps to encourage as many people as possible [within the organisation] to take risks and innovate and to get out of the habit of asking permission and waiting for instructions” (Pedler *et al.*, 1997: 118). Employees

in the companies that score low on this item fear to experiment with something new and prefer to play safe. The company does not encourage people to take the initiative in their work.

Change is embraced by everyone

This means that the company's alignment to change and the adoption or implementation of new initiatives is supported by all employees. Everyone in the company is prepared to change the way they work. Companies that score low on this area tend to maintain old beliefs that lead to conservative behaviour and an unwillingness to experiment with new ideas.

Common values are reflected in the company policies

This means that all members of the organisation are involved in the policy-making process by which they "have a chance to contribute to and debate major policy decisions" (Pedler *et al.*, 1997: 79). Companies that score low in this aspect often centralise the development of company policies and then expect employees to comply with those policies.

Information is easily accessible for everyone

This means that the company "provides people with access to all relevant information held by the company to speed action, create public domain databases which speeds information flow to the point in the organisation, ...and are designed to encourage learning" (Pedler *et al.*, 1997: 92). Facilities that can foster public access to information include intranets, email, bulletin boards, and a hall for informal meetings. In companies that score low on this item, there are few opportunities or resources available for the widespread public sharing of information.

Personal development is fully supported

This means that the company frees employees from managing their own-development by providing opportunities, resources, and guidance. A company's career planning is aligned with individuals' learning needs. Also employees are encouraged to take responsibility for decisions that directly affect their work. Companies that score low on this item lack the budget or resources for personal development. If they train people, they may not consider employees' career aspirations and learning interests.

Informal learning is fully facilitated

This means that the company provides sufficient resource systems for informal learning such as libraries, learning centres, space for informal chatting and the exchange of stories. Companies that score low on this item do not sufficiently encourage informal learning, or tend to attach it to tangible organisational incentives. Time spent in informal learning is viewed as being taken away from real work.

Inter-personal and team interactions are fully promoted

This means that “individuals, groups, departments and divisions exchange information on expectations, and give feedback on goods and services received” (Pedler *et al.*, 1997: 106). This will inherently lead to the setting of norms of trustworthy behaviour. Companies that score low on this area may have a culture of suspicion. Hierarchy and status may also restrict the free flow of ideas and information.

Autonomy is given to each project team

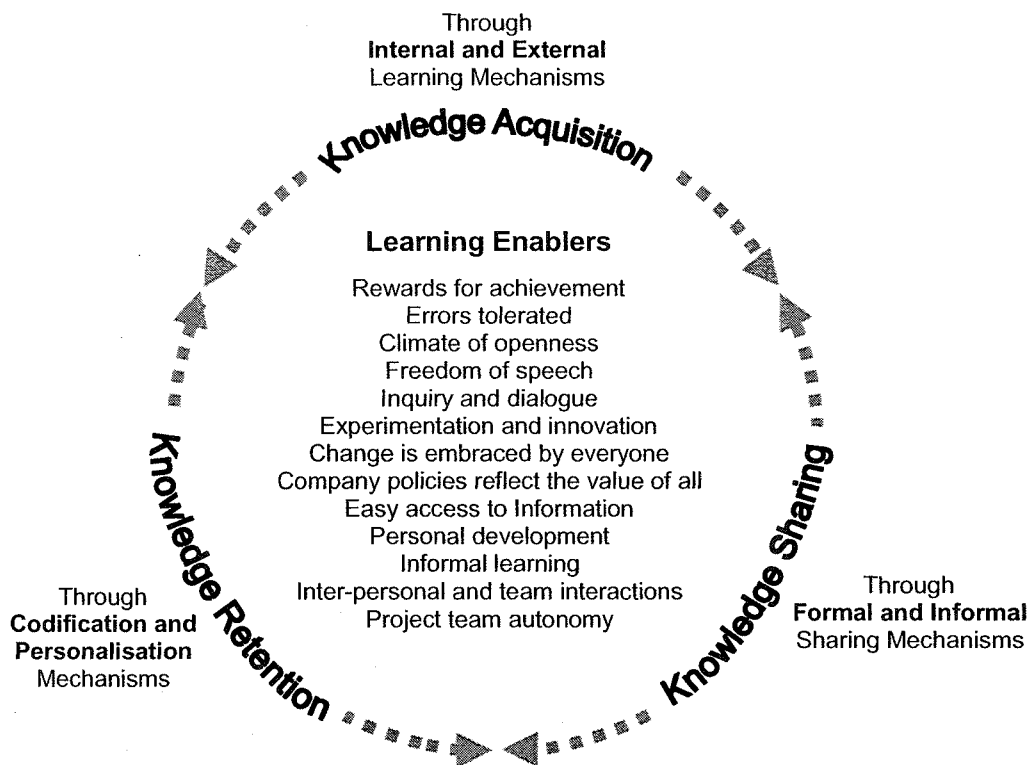
Sufficient authority and flexibility are given to project teams on site to act and adapt their working strategies as needed, without long procedural formalities that can slow down project delivery. Project teams are also given adequate space to govern their learning strategies. Companies that score low on this item restrict the freedom of project teams to alter and adapt their task execution on site, which in effect impedes any opportunity to innovate and improve their practices.

3.2 A Framework for Investigating Learning in Construction Organisations

3.2.1 Conceptual Model

As stated earlier, organisational learning occurs principally through the three processes of knowledge acquisition, knowledge sharing and retention. Each process entails different mechanisms and enabling conditions. *Figure 3.7* represents the conceptual model of an organisational learning system adopted as a framework for investigating learning in construction organisations.

Figure 3.7
Elements of an organisational learning system



The framework consists of three essential elements: (1) learning processes – represents a cyclical interaction of different activities that support knowledge acquisition, knowledge sharing and knowledge retention; (2) learning mechanisms – various organisational establishments that provide a venue for knowledge acquisition, knowledge sharing and knowledge retention, and (3) learning enablers – a set of organisational activities that positively affect organisational learning competence.

The operationalisation of this model is achieved through the development of hypotheses as will be provided in the following sections.

3.2.2 Development of Hypotheses

In order to address the main research question and to evaluate how construction learning companies manage their learning practices, the initial phase of the research examined these issues in the context of the existing literature. The relationships between the main variables of the research model were examined through the postulation and testing of hypotheses derived from the above-mentioned literature. Whilst these hypotheses in themselves could not provide a comprehensive answer to the main research problem, they did constitute a foundation and framework for the research direction. The hypotheses that are developed in the following sections were postulated to describe the relationships between a choice of a set of learning mechanisms and the organisational characteristics specific to the company.

Knowledge Acquisition

According to Watkins and Marsick (1993), all learning organisations have embedded systems or mechanisms to capture and share learning. However, the extent to which direction learning is emphasised differs from one to another. Kessler *et al.* (2000) highlight two distinct strategies for knowledge acquisition: internally sourced and externally sourced. Each has different implications with regard to learning, but they are not mutually exclusive. A particular company may need to develop one area of knowledge whilst simultaneously exploiting another. However, March (1991) proposes that organisations must continually find the balance between exploitation and exploration for survival and prosperity. A similar argument is expressed by Zack (1999), Garratt (2000) and others such as Pedler *et al.* (1997), whose concept of ‘looking-in’ and ‘looking-out’ strategies suggest that successful learning companies depend upon their ability to keep a balance between developing knowledge internally and acquiring knowledge externally.

Hypothesis 1: High learning companies are more likely to engage in a more balanced use of internal and external learning mechanisms than are low learning companies.

Hypothesis 2: Construction companies that exhibit more balanced practices between internal and external learning mechanisms are more effective than those that do not.

There is a natural tendency for senior managers to focus on efficiency gains, rather than to explore new solutions to emerging needs (March, 1991). This creates imbalanced stocks of organisational knowledge from internal sources and external sources. Consequently, superstitious learning may occur, whereby managers draw incorrect conclusions about the impact of their organisational actions on the environment (Levitt and March, 1988). This phenomenon is especially common when there is a positive correlation between a managerial action and a subsequent favourable event.

Hypothesis 3: Construction companies that focus heavily on exploiting knowledge from internal sources without sufficiently exploring external knowledge are more likely to experience superstitious learning.

Knowledge Sharing

DiBella *et al.* (1996) identify two different approaches to knowledge sharing: formal and informal. The informal approach to knowledge sharing exploits the social nature of a workplace environment. The spread of knowledge within the organisation is facilitated by the meetings or interactions between people through various socialisation mechanisms. However, as organisations grow in size and broaden their geographical operations, the practice of sharing knowledge through face-to-face interaction becomes ineffective. Such organisations need to extend their informal mechanisms in order to facilitate the transfer of knowledge beyond small and collocated groups.

Boh (2007) discovered that larger and geographically dispersed organisations tend to use a mechanisation strategy where the distribution of knowledge is channelled through formalised and structured mechanisms that connect between groups or units within the organisation. Similarly, Olivera (2000) found that formalised knowledge sharing mechanisms are particularly relevant for multi-unit organisations.

Hypothesis 4: Larger and geographically dispersed construction companies are more likely to rely on the use of formal knowledge sharing mechanisms than are smaller and collocated companies.

Hypothesis 5: Smaller and collocated construction companies are more likely to rely on the use of informal knowledge sharing mechanisms than are larger and geographically dispersed companies.

Knowledge Retention

Hansel *et al.* (1999) found that effective organisations excel by predominantly focusing on using either the codification or personalisation mechanism for retaining organisational knowledge, and using the other in a supporting role. The routine tasks of the organisation and the nature of its internal business environment determine on which set of mechanisms the company should focus. Hansen and his associates show that technical consulting companies, whose task nature tends to be more standardised across projects, benefit more from a codification strategy. The codification approach allows such company to build a reliable, high-quality repository system so that it can deliver faster and at a better price than can others by using standardised methods and solutions that have been fine-tuned and proven successful. On the other hand, strategy consulting companies that tackle problems that do not have clear solutions at the outset tend to benefit more from the personalisation approach. By adopting this approach, allows employees in such a company to engage with their colleagues in discussions to seek a highly customised solution to each unique problem.

Hypothesis 6: Codification mechanisms for retaining knowledge are more suitable for construction companies handling projects or encountering problems that are more standardised and repeatable in nature.

Hypothesis 7: Personalisation mechanisms for retaining knowledge are more suitable for construction companies handling projects or encountering problems that are more customised and unique in nature.

3.2.3 Summary of Hypotheses

A set of hypotheses based on the theories reviewed was developed. The purpose of developing these hypotheses was not only to confirm the proposed model, but also to explore the interrelationships between different variables of the model. *Table 3.1* provides a summary of the hypotheses that were developed in the preceding sections.

Table 3.1
Summary of hypotheses

Learning process	Hypothesis	Learning mechanisms	
Knowledge acquisition	<p>H₁: High learning companies are more likely to engage in a more balanced use of internal and external mechanisms.</p> <p>H₂: Construction companies that exhibit more balanced practices of internal and external learning are more effective.</p> <p>H₃: Construction companies that focus heavily on exploiting knowledge from internal sources without sufficiently exploring external knowledge are more likely to experience superstitious learning.</p>	Internal knowledge <ul style="list-style-type: none"> ▪ Quality circle ▪ Project reviews ▪ Lessons learned from failures ▪ Lessons learned from successes 	External knowledge <ul style="list-style-type: none"> ▪ Project teams as learning sensors ▪ Marketing division ▪ External expertise to scan market ▪ Benchmarking
Knowledge sharing	<p>H₄: Larger and geographically dispersed companies are more likely to rely on formal sharing mechanisms than the smaller and collocated companies.</p> <p>H₅: Smaller and collocated companies are more likely to rely on informal sharing mechanisms than are larger and geographically dispersed companies.</p>	Informal sharing <ul style="list-style-type: none"> ▪ Social meetings and Informal gatherings ▪ Personal networking ▪ Informal story-telling sessions ▪ Onsite information exchange ▪ Exchange of personal notes ▪ Voluntary case writings 	Formal sharing <ul style="list-style-type: none"> ▪ Formalised communities of practice ▪ Inter-project visit schemes ▪ Intranets ▪ Company newsletters ▪ Lessons learned databases ▪ Standardisation of methods or best practices
Knowledge retention	<p>H₆: Codification mechanisms for retaining knowledge are more suitable for companies handling projects or encountering problems that are more standardised and repeatable in nature.</p> <p>H₇: Personalisation mechanisms for retaining knowledge are more suitable for construction companies handling projects or encountering problems that are more customised and unique in nature.</p>	Codification <ul style="list-style-type: none"> ▪ Codified information ▪ Personal notes ▪ Personal case writings ▪ Standardised methods or best practices ▪ Databases ▪ Company newsletters 	Personalisation <ul style="list-style-type: none"> ▪ Stories ▪ Personal networks ▪ Social activities ▪ Communities of practice ▪ Project sites ▪ Intranets

3.3 Chapter Conclusions

In this chapter, a model of an organisational learning system was discussed and a conceptual framework for evaluating the practice of organisational learning in construction companies was developed. The framework consists of three elements: learning processes, learning mechanisms and learning enablers. The dimensions of each element of this framework were generated from the literature reviewed in Chapter 2.

A set of hypotheses was developed based on the existing theories. The establishment of these hypotheses was not only to confirm the proposed model, but also to explore the interrelationships between the elements and variables of the model.

4. First Stage Data Collection and Sample Validation

Be convinced that, if man were able to reach the end without preparatory studies, such studies would not be preparatory but tiresome and utterly superfluous.

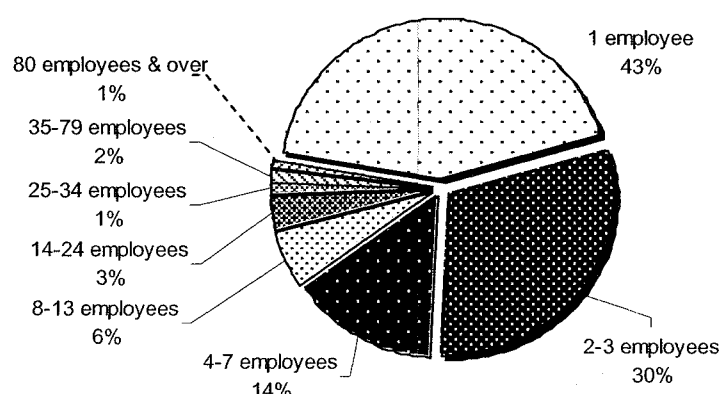
-Moses Maimonides (1135-1204)

This chapter reports on the first stage data collection and sample validation processes that preceded the central part of the investigation. As was highlighted in Chapter 1 (Section 1.5), the full research process involves different stages of data collection. The first stages of the data collection took the forms of a business environment audit and a company learning assessment (*i.e.* learning competence test). The general purpose was two-fold: to provide credible samples for the research and to establish the business context for the samples.

4.1 The Business Environment Audit

The primary aim of the business environment audit was to identify a comparable group of companies that could be analysed in greater depth. The well-known problems of fragmentation and variation in the construction industry necessitated the justification of this process. As a case in point, about 87% of UK-based private contractors are micro businesses employing no more than seven employees (see *Figure 4.1*), and 43% of them are merely sole entrepreneurs or proprietors (*DTI, 2006*).

Figure 4.1
The distribution of UK construction companies by number of employees (DTI, 2006)



Given this condition, to generalise or to consider very large companies together with smaller sub-contractors makes little analytical or statistical sense. “Any results, whether they be simple descriptions or more rigorous statistical analysis, will be biased” (Ball *et al.*, 2000: 739). Therefore, for the purpose of the current research, the sample was selected to exclude small businesses. The definition of small businesses followed the Recommendation of European Commission (Schmiemann, 2006). Article 2, point 2 of the Annex of the Recommendation, which defines a small business “as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million”. In addition, recent studies have reported that smaller construction companies have proved difficult to study owing to their lack of formal structure, systematic processes, and documentation (Kululanga *et al.*, 2001; Love *et al.*, 2004).

4.1.1 The Audit Process

A Business Environment Audit Questionnaire was sent out to 100 construction companies in order to establish their business context. These companies were at the top of the list of active members of the government-supported *Constructing Excellence* initiative in North East England that engaged in various performance enhancement programmes. The top level of management or directors of the companies were approached with the help of the *North East Constructing Excellence* office. The managers/directors were requested to respond to a 12-question questionnaire (see *Appendix I*) assessing the internal and external business environment within which their company operated; such as position in the market, experience of procurement systems, geographical coverage of operations, category of construction activity, sector of activity, nature of construction work, size of projects, number of direct employees, typical project team size, project organisation, and willingness to support future investigation.

Thirty-four companies responded to the questionnaire, yielding effectively a 34% return. Two respondents returned the questionnaire uncompleted and commented that their companies would not be appropriate to the research as they identified themselves

as private house-builders (or speculative house-builders) rather than contractors². Follow-up phone calls were made two weeks after the initial questionnaire distribution to those companies that had not returned the questionnaire. The most commonly cited reasons for non-response were:

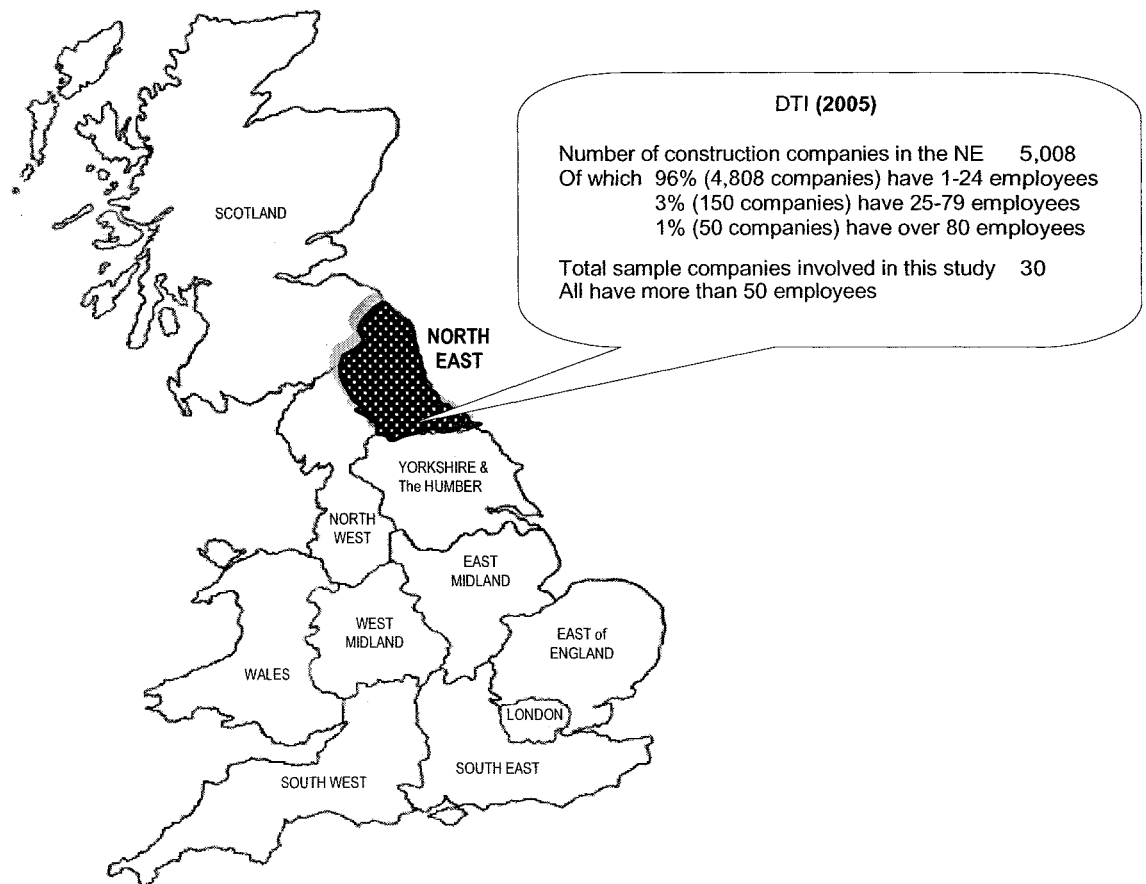
- they belonged to the micro business category;
- they were not engaged in contracting activities; or
- they opted not to be involved in the research.

In order to maintain a consistency with the above and the previously established criteria, two responding companies that fell into these categories were then eliminated from the further contact list. As a result, 30 companies were selected in accordance with sample sizes set out in Roscoe's (1975) rule of thumb.

The following sections present the information provided by these 30 companies and its analysis. Individually, each represents the internal and external business situation of the corresponding companies. Together they expose a snapshot of the North East construction activities from which the current research finds its geographical context (see *Figure 4.2*).

² Contractors generally build for clients, whilst speculative house-builders build first and then seek a client (Pearce, 2003: 9).

Figure 4.2
Geographical context of the present study

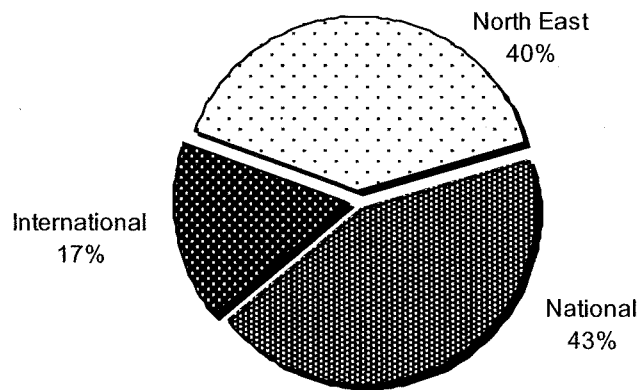


4.1.2 Results

Geographical Area

Although all the participating companies were contacted through their North East base office, it was anticipated that they might work beyond this area. The data from 30 companies (see *Figure 4.3*) shows that as many as 43% extend their area of activity to other areas of the UK, whilst 17% extend their operation beyond national borders. Local companies – those that focused their work within the North East only – accounted for 40%.

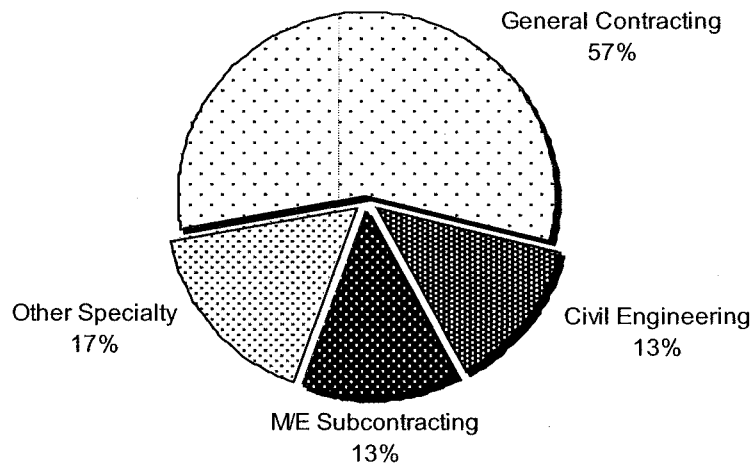
Figure 4.3
Geographical coverage of works by sample companies



Category of Construction Activity

The most frequently quoted category of construction activity was general contracting, regardless of the differing geographical coverage of the companies. This was referred to by 57% of sample companies (see *Figure 4.4*). The remaining companies fell into the specialty contracting category to include civil engineering, M/E contracting, and other subcontracting.

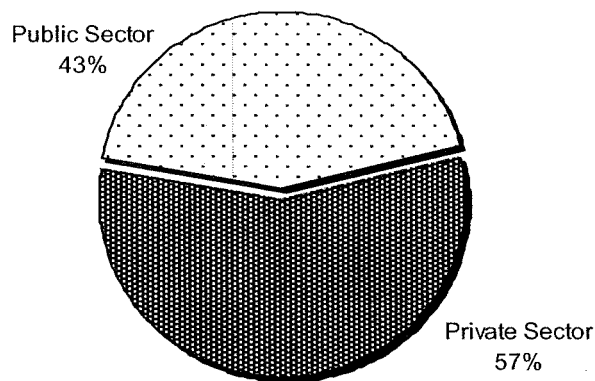
Figure 4.4
Categories of construction activity by sample companies



Private versus Public Sector

Directors/managers of the sample companies were asked to categorise the majority of their work according to whether it fell into the *private* or the *public* sectors. Responses indicated that some 43% of the North East construction activities are funded by the public sector, which collectively makes it one of the largest construction clients in the region (see *Figure 4.5*). The private sector provides 57% of the total contractors' work. This proportion signified a good distribution within the construction market in the area being observed. In most cases, the construction market is dominated by the public sector, as is evidenced almost anywhere else, with the exception, of course, of a few economically mature regions or countries (Wang and Yang, 2000; Datta, 2000; Davis Langdon, 2003; *DTI*, 2004).

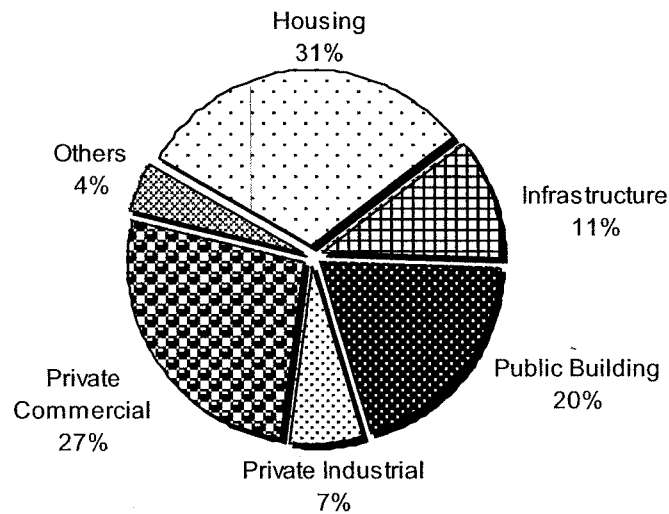
Figure 4.5
Composition of construction works by sample companies



Type of Work

A large majority of sample companies had been working on several types of buildings. As shown in *Figure 4.6*, the most frequently quoted were *housing*, *private commercial*, *private industrial* and *public housing*, which together accounted for 85%. All of these types of building, except the *public building*, can be closely associated with typical private-sector buildings. The figure presented in the previous section seems very much consistent with this.

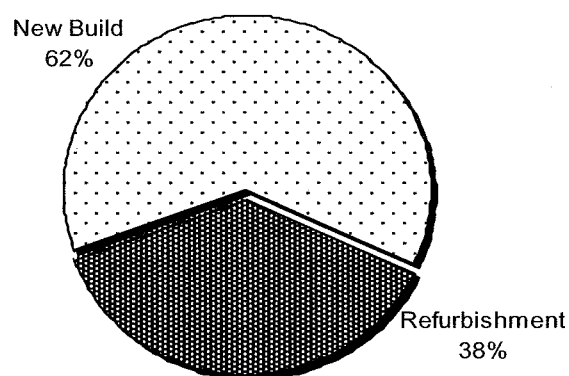
Figure 4.6
Type of work carried out by sample companies



Construction Classification

An overwhelming majority of construction works, as evidenced from the current data, were *new-build* constructions (62%); and the remaining 38% were *refurbishments* or *maintenance*. Figure 4.7 shows the composition of construction output between new build and refurbishments or maintenance.

Figure 4.7
Construction classification by sample companies

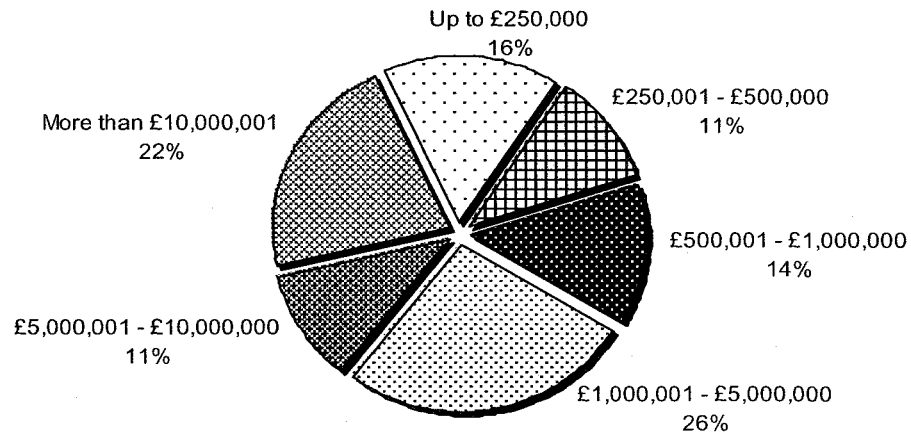


Size of Projects

Directors/managers were asked to identify the typical size of their projects over the last four years. The results (Figure 4.8) show a somewhat even distribution of responses across the range of project sizes. Sixteen percent of the responses quoted relatively

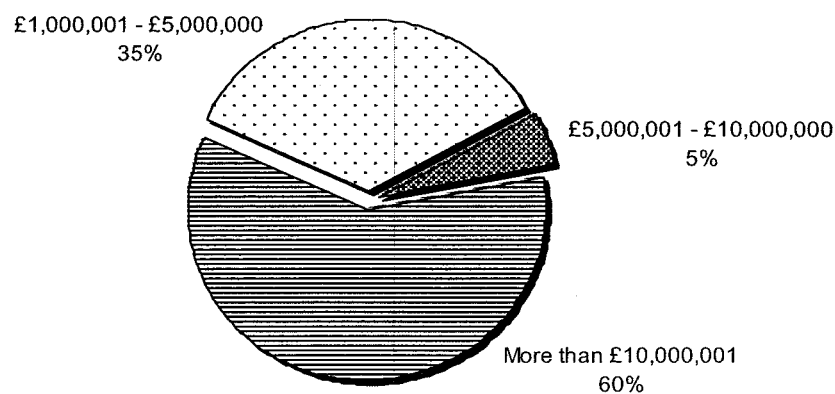
small projects of less than £250,000, whilst another 22% belonged to the classification of large projects costing £10,000,001 or more. However, the most projects (26%) were within the size of £1,000,001 and £5,000,000.

Figure 4.8
Size of projects engaged by sample companies



A similar question was also asked with regard to the largest project the companies had undertaken since 2000 and the result is presented in *Figure 4.9*. Eighteen companies out of thirty claimed that they had handled projects valued at £10,000,001 or more. Three companies, rather surprisingly, quoted that they had been working with exceptionally large projects costing more than £45m, £70m and £510m, respectively. However, all of these three companies were talking about projects on a national scale, rather than North East-based projects.

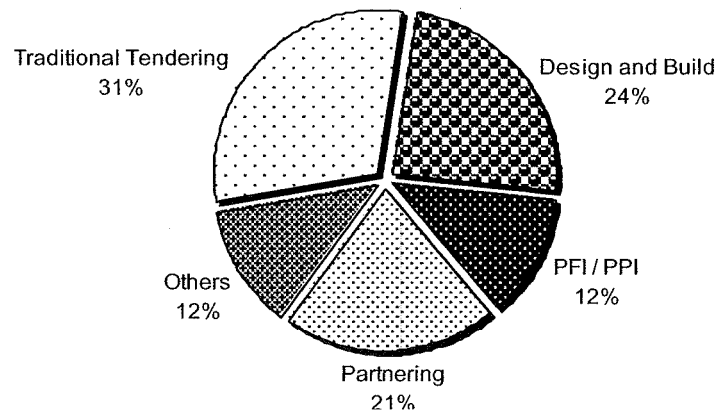
Figure 4.9
Largest projects handled by sample companies



Procurement Systems

A question regarding the type of procurement system most usually engaged in by the sample companies revealed the following picture (see *Figure 4.10*). The *traditional tendering* type was still the most frequently used system scoring 31% responses. The second and third most common systems were *design & build* (24%) and *partnering* (21%), respectively. Whilst an earlier section identified a significantly high proportion of *private sector* contributions to the composition of the overall population of construction projects, the *PFI/PPI* type of procurement scored only 12% of the responses.

Figure 4.10
Procurement system engaged by sample companies



Number of Direct Employees

In order to have a picture about the size of construction companies operating in the North East in terms of their number of employees, directors/managers of the sample companies were requested to tick one out of five options. *Figure 4.11* presents the results. Responses from 32 companies showed that well over 75% of companies employed more than one hundred personnel, 37% of which secured more than 1000 permanent members of staff in their business. Only two companies (6% of participating companies) maintained a relatively small team of less than fifty direct employees. Due to the nature of the sampling procedure, which was drawn from the *Constructing Excellent* members, this picture in itself does not necessarily provide the best representation of the construction business environment at the industry level. At best, these companies represent only the 1% of construction companies that have more than 80 employees, as depicted in *Figure 5.1*. However, in terms of business output, they

typically contribute well over a half of the total construction companies' output, either regionally or nationally (DTI, 2006).

Furthermore, due to sample selection criteria as stated earlier, two companies that had fewer than 50 direct employees were excluded from the samples. As a result, a new composition of company size by sample companies emerged (see *Figure 4.12*).

Figure 4.11
Number of direct employees by responding companies

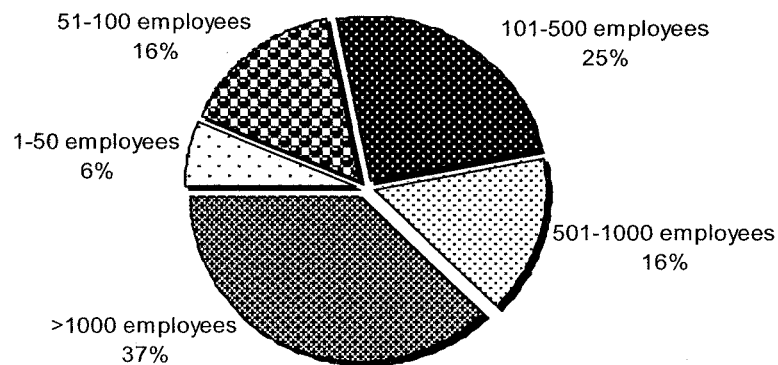
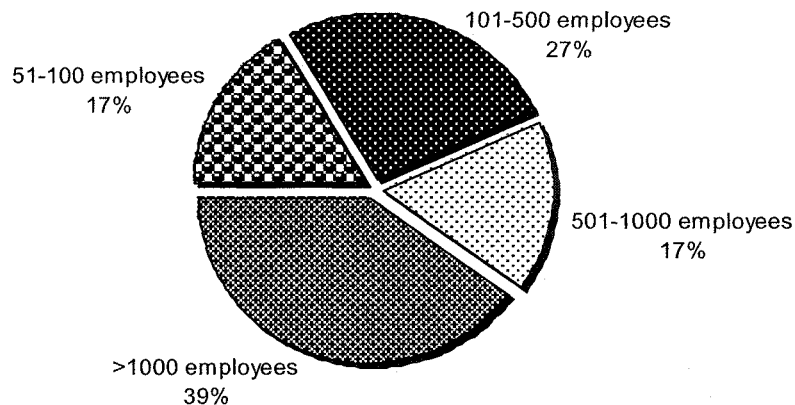


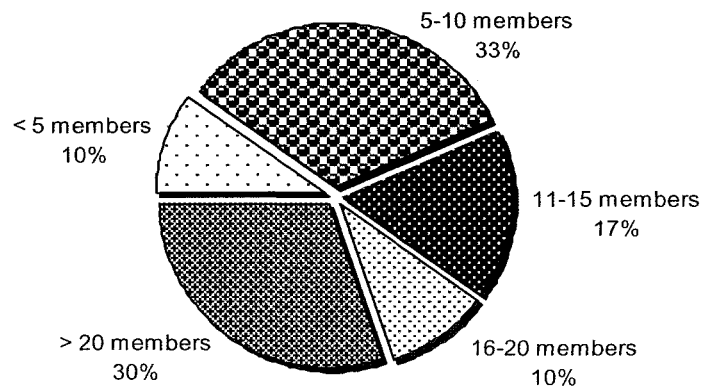
Figure 4.12
Number of direct employees by 30 sample companies



Size of Project Teams

As shown in *Figure 4.13*, the size of project teams varies considerably. More than half the responses typified the use of project teams with 5 to 10 members (33% responses) and project teams with more than 20 members (30% responses). The remaining responses were teams with fewer than 5 members or with 11 to 20 members. The variation in the size of project teams almost certainly corresponds to the variation of project types and sizes (see *Figures 4.6* and *4.8*).

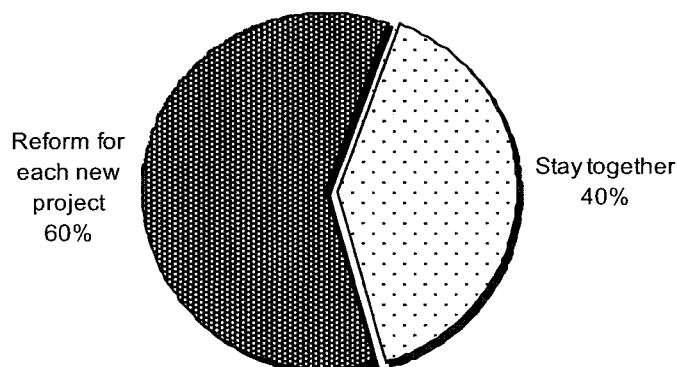
Figure 4.13
Number of direct staff employed by sample companies



Project Team Organisation

Directors/managers were also asked about how their project teams were organised. Sixty percent of companies tended to *reorganise* the composition of their project teams *for each new project*, whilst the other 40% claimed their project teams *stayed together* for different projects (see *Figure 4.14*).

Figure 4.14
Project team organisation by sample companies



Future Involvement

The last section of the questionnaire asked if respondents would be prepared to be involved further in the research project. Only one respondent replied that his company was unable to participate, meaning that almost all respondents indicated their availability to participate. Arguably, the fact that they responded to the questionnaire had already shown a sign of willingness to participate and that, at least to a lesser degree, they had paid some attention to the importance of learning. Three respondents gave a note emphasising their availability to be involved in the research. This was a particularly positive sign that managers within construction companies have shown concern about the issues of learning in organisations.

4.1.3 Summary: A Snapshot of the NE Construction Activities

The overall information as highlighted in the analysis section provides a picture of what construction organisations in the North East typically look like in terms of their internal and external business environments. It should be noted, however, that this analysis is strictly based on 30 companies that are members of *Constructing Excellence* in the North East. To summarise the profile of these companies, some main points are given below.

In terms of geographical coverage, the figure shows that 40% of companies focused their operations within the North East area only. Their activities were distributed equally between the *public* and *private sectors*, and their category of activities was mainly *general contracting* (57% companies).

Among the five construction types identified (*housing, infrastructure, public building, private industrial, and private commercial*), none had become a particular preference. Although the *housing* and *private commercial* types took a significantly larger part of the pie, hypothetically, this can be related to the trend of economic development, that is, the shift toward the North East region (*Building*, 2003; Monaghan and Lane, 2007). Correspondingly, the *new build* construction type was greater in number (62%) than that of *refurbishment* (38%). This figure was also well above the national average, which typically has a 55/45 composition for *new build* and *refurbishment*, respectively (*DTI*, 2006).

The median size of the projects was in the range of £1,000,001 – £ 5,000,000. However, some respondents claimed that their largest projects exceeded £10,000,000. A closer look at a possible relationship between *new build* versus *refurbishment* and the size of project failed to find a strong correlation, since some of the *new build* projects were relatively small in size, and vice versa.

The *traditional tendering* approach still dominated the way projects were procured in the North East, accounting for 31%. The other two systems quoted frequently were *design & build* and *partnering*. In terms of company size, the largest portion of the samples (53%) is taken by a group of companies that employed more than 500 staff. Furthermore, findings from this business environment audit survey disclosed some preliminary data about how project teams within the construction companies were organised, *i.e.* whether they were *reformed for each new project* or *stayed together*.

A closer examination of the data found some indicative relationship between the category of construction activity (*Figure 4.4*) and the way the project teams were organised (*Figure 4.13*). Companies that engaged in *general contracting* tended to *reform their project teams* for each new project, whilst companies that declared themselves as engaged in *civil engineering*, *M/E contracting* and *other specialty subcontracting* almost consistently claimed that they were in favour of maintaining their project teams and had them *stay together for the next project*.

In summary, although this presentation of data is exclusively based on 30 sample companies, these companies represent the few construction organisations that probably dominate some parts of the construction activities in the North East. The quality of data provided by directors/managers was excellent in terms of consistency, completeness and clarity. There was no indication of confusion or difficulty in answering the questions in the business environment audit survey, signifying its relevance and level. In themselves, these initial findings contain new empirical data and present an informative snapshot of the North East construction activities, from which the current study derives its context.

4.2 The Learning Competence Test

Following the business environment audit, the second research process to be carried out was the learning competence test. The primary purpose of this test was to segregate the participating companies in terms of their degree of conformity with the idealistic attributes of organisational learning competence. This procedure was necessary in order to select two smaller groups of case companies to be involved in the full data collection process. The statements provided in the learning competence questionnaire were based on the construct developed in Chapter 3, Section 3.1.4.

A secondary objective integral to this process was to examine if any relationship exists between organisational attitudes toward learning and a company's general performance such as growth and profitability, and characteristics such as size and age. The underlying assumption is that the higher the organisation's performance ratings on the set of thirteen learning competence criteria, the greater its chances of having higher growth rates and, probably, better profits.

The objective data about companies' financial performance were obtained from the *FAME (Financial Analysis Made Easy)* databases and confirmed by secondary sources such as company reports and publications.

4.2.1 The Assessment Process

Following up the previous contacts made in the business environment audit stage, directors/managers of the 30 short-listed companies were asked via a personal email to assess the extent to which their companies correlated with the idealistic practices of a high learning company. Thus, the respondents were asked to answer the questions in a way that represented their company as a whole, rather than reflecting the views of the individual respondent. A 5-point Likert scale (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and 1 = strongly disagree) was used to measure the level of agreement against 13 statements representing the ideal qualities of a high learning company (see *Table 4.1*). A very similar questionnaire design was used by Montes *et al.* (2004) and Chandler *et al.* (2000) to measure the organisational climate for innovation.

Table 4.1
Statements representing the ideal qualities of a learning company

<i>Question</i>	<i>Statement</i>
Q1	In my company, rewards are given for every achievement.
Q2	In my company, considerable errors are tolerated.
Q3	In my company, there is a climate of openness.
Q4	In my company, everyone has freedom of speech.
Q5	In my company, inquiry and dialogue are normal practice.
Q6	In my company, experimentation and innovation are normal practice.
Q7	In my company, change is embraced by everyone.
Q8	In my company, the common values of employees are reflected in company policy.
Q9	In my company, information is easily accessible for everyone.
Q10	In my company, personal development is fully supported.
Q11	In my company, informal learning for everyone is fully supported.
Q12	In my company, inter-personal and team interactions are fully promoted.
Q13	In my company, project teams are almost autonomous from home office.

Each response was followed by a telephone interview to confirm the information given in an attempt to eliminate misjudgement or misinterpretation, but also to clarify some questions arising from statements made in the questionnaire. A questionnaire guide containing a simple explanation and elaboration of each questionnaire statement was prepared and distributed as an attachment to the questionnaire form (see *Appendix 2*). *Table 4.2* provides an example of a questionnaire statement and its description reproduced from question 5. This treatment increased the validity of the information, and hence reduced the risk of instrument bias.

Table 4.2
An example of questionnaire statement and its description

Q5	<i>In my company, inquiry and dialogue are the norms</i>	How does your company encourage an open exchange of ideas? Are people challenged to ask their colleagues, if there is something they do not know?			
1	2	3	4	5	Companies that scored low on this item did not invite challenge or inquiry for understanding.
					Companies that scored high encouraged an open exchange of ideas and knowledge sharing.

Directors or top managers were the main source of data collection in this learning assessment process; because, according to Goh and Richards (1997) and Jashapara (1993), they are well versed with knowledge about the overall learning strategy and management of a company.

Table 4.3 shows the characteristics of the sample companies, along with the overall company learning scores. As a result of the natural selection process in the business environment audit, the companies that participated at this stage were from the top tier of companies in the region. Accordingly, the sample was non-random and not strictly representative of the construction industry in North East England.

Table 4.3
Characteristics of companies in the study sample

Company	Area of main contracting activities	Management Status	Years in business	Size (Number of employees)	Turnover Growth (%)	Profitability (ROI)	Company Learning	
							Score	Rank
1	Spec Roofing	Head Office	40	170	6.9	26.7	47	10
2	Gen Building	Head Office	50	140	42.2	17.7	52	5
3	Multidiscipline	Branch	104	24.000	9.1	11.9	55	3
4	Gen Building	Head Office	7	90	23.6	37.7	46	11
5	Gen Building	Branch	142	1.810	12.2	34.4	48	9
6	Gen Building	Head Office	100	200	30.5	17.8	57	1
7	Spec Civil	Head Office	29	210	22.0	34.6	49	8
8	Spec Subcons	Branch	29	510	8.1	41.0	50	7
9	Gen Building	Branch	110	1.510	12.3	17.3	51	6
10	Spec M/E	Branch	86	4.000	7.4	20.5	57	1
11	Gen Building	Head Office	34	60	10.0	1.7	48	9
12	Multidiscipline	Branch	138	1.670	8.8	17.1	48	9
13	Spec Roofing	Head Office	35	110	26.7	19.3	49	8
14	Gen Building	Branch	86	4.020	-5.3	14.0	47	10
15	Spec Plumbing	Head Office	114	90	15.0	8.7	49	8
16	Multidiscipline	Branch	85	830	11.1	5.5	48	9
17	Gen Building	Branch	117	920	14.5	16.7	48	9
18	Spec Glazing	Head Office	25	200	3.8	53.6	55	3
19	Gen Building	Branch	123	2.100	4.8	32.7	48	9
20	Gen Building	Head Office	36	90	10.0	9.4	50	7
21	Spec Water	Branch	23	250	2.9	64.4	42	13
22	Gen Building	Branch	98	13.500	8.9	24.0	47	10
23	Gen Building	Branch	99	2.200	11.8	29.9	51	6
24	Spec Ceiling	Head Office	24	100	2.9	43.8	45	12
25	Multidiscipline	Branch	159	22.000	54.9	43.4	57	1
26	Spec M/E	Branch	191	1.400	1.9	35.6	46	11
27	Spec Refurbishmer	Branch	79	750	59.1	31.4	54	4
28	Spec Instrumentation	Head Office	87	400	7.6	13.9	41	14
29	Gen Building	Branch	155	860	10.0	39.7	49	8
30	Gen Building	Branch	104	1.800	-3.2	20.5	56	2

4.2.2 Results

A correlation test was conducted on the data to investigate the relationship between organisational learning competence factors and general company performance (*i.e.* turnover growth, profitability, company size and age). The Spearman's rank correlation coefficients are given in *Table 4.4* where a significant relationship was indicated. A non-parametric test was used because the data did not satisfy all the assumptions of the parametric tests – independency, normality and homogeneity of variances. Furthermore, the sample for this study was not purely random, and significance levels were used merely to indicate the strength of the relationships found, not to make inferences about the general population of the construction businesses.

Organisational Performance

Whilst recognising that organisational performance is a multidimensional concept, this study focused only on company growth performance. The most commonly used indicators of company growth are financial, such as an increase in turnover and profit (He and Wong, 2004). These provide an indication of performance over a period of time in terms of some of the most important financial goals of any business. The present study used the average increase in turnover by the sample companies for a five year period.

The results of Spearman's rank correlation test indicate there was no significant correlation between company growth and the overall learning competence index ($r = 0.184$, $p = 0.166$). The criterion of profitability also failed to reach significance ($r = 0.060$, $p = 0.377$). The one criterion that was significantly correlated with company growth in terms of increased turnover was '*experimentation and innovation*' ($r = 0.534$, $p < 0.01$). This clearly supported the concept of exploration (March, 1991) that associates company growth performance with exploration activities such as searching for, discovering, creating, innovating and experimenting with new opportunities (Nicholls-Nixon *et al.*, 2000; Salojarvi *et al.*, 2005). In a study of "growth firms" in the context of facilities management, Dettwiler (2006) found a strong link between a rapid growth in turnover and the intensity of experimentation with the workplace design.

Table 4.4
Nonparametric Correlations

Spearman's rho

	Mean	Std. Dev.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Reward for achievement	3.93	0.52	1.000																
(2) Errors tolerated	3.13	0.78	.201	1.000															
(3) Climate of openness	4.13	0.49	.034	.162	1.000														
(4) Freedom of speech	4.37	0.89	.429	.196	.496(**)	1.000													
(5) Inquiry and dialogue	3.80	0.65	.163	.075	.003	.236	1.000												
(6) Experimentation and innovation	3.70	0.92	.275	.020	.184	.105	.258	.040	1.000										
(7) Change is embraced	3.33	0.83	.402	.001	.283	.417	.085	.115	.000										
(8) Participative company policies	3.83	0.81	.259	.014	.345(*)	.002	.305	.273	.731(**)	1.000									
(9) Easy access to information	3.97	0.66	.239	.083	.510(**)	.614(**)	.230	.436	.000	.054	1.000								
(10) Personal development	4.10	0.63	.319	.189	.306(*)	.107	.009	.038	.029	.388	.048	1.000							
(11) Informal learning	4.13	0.74	.467	.153	.366(*)	.143	.002	.427	.404	.465	.401	.254	1.000						
(12) Team interaction	4.07	0.91	.473	.218	.023	.220	.058	.364	.486	.285	.007	.088	.409(*)	1.000					
(13) Project teams autonomy	3.17	0.32	.087	.202	.190	.232	.125	.172	.113	.228	.220	.298	.497(**)	.142	1.000				
(14) AGGREGATE	49.67	4.19	.188	.630(**)	.450(**)	.587(**)	.255	.373(*)	.638(**)	.562(**)	.328(*)	.055	.302	.326(*)	.446(*)	1.000			
(15) SIZE	2899.67	6026.17	.118	.095	.427(**)	.164	.002	.165	.057	.226	.351(*)	.102	.052	.131	.743(*)	.224	1.000		
(16) AGE	84.97	46.48	.121	.328	.009	.193	.486	.192	.382	.115	.029	.296	.000	.246	.000	.117	.598(**)	1.000	
(17) TURNOVER GROWTH	12.41	13.54	.281	.375	.118	.048	.024	.037	.050	.192	.251	.144	.005	.015	.516(**)	.150	.000	.232	1.000
(18) PROFITABILITY	21.89	32.01	.196	.060	.172	.244	.063	.534(**)	.022	.163	.020	.095	.086	.105	.377	.099	.166	.109	.821(*)
			.045	.253	.138	.076	.052	.178	.015	.034	.458	.309	.226	.236	.236	.060	.239	.089	.358
			.408	.089	.233	.345	.393	.173	.469	.428	.325	.308	.115	.291	.105	.377	.101	.358	.000

* Correlation is significant at the 0.05 level (1-tailed).

** Correlation is significant at the 0.01 level (1-tailed).

a Listwise N = 30

There was also a significant correlation ($r = 0.621, p < 0.01$) between company growth and profitability as measured by the average return on investment [ROI] using data from a five year period. This indicates that the profitability measure used in this study would have been a good predictor for organisational growth. *Table 4.5* summarises two variables that showed a significant correlation with company growth.

Table 4.5
Spearman's Rank correlation between two variables and company growth

<i>Variable</i>	<i>Spearman's Rho (N=30)</i>
Experimentation and innovation	0.534**
Profitability	0.621**

** Correlation is significant at the 0.01 level (1-tailed).

Correlation of Size with Learning Competent Factors

It was noted that most variables were not significantly correlated with the size of the construction companies. However, *Table 4.4* shows that the *climate of openness, easy access to information, project team autonomy, and supported informal learning* variables were significantly correlated with the number of direct staff employed by a construction company at higher than the 95% confidence level. The intensity of informal learning was inversely proportional to the size of the construction companies studied. The number of employees was chosen as a measure for company size instead of sales revenues, because construction companies have generally unstable revenues depending upon the size of projects they handle in a particular year.

Table 4.6 summarises the Spearman's rank correlation coefficients between four learning competence factors and company size.

Table 4.6
Spearman's Rank correlation between selected learning competence criteria and company size

<i>Competence Criteria</i>	<i>Spearman's Rho (N=30)</i>
Climate of openness	0.427**
Easy access to information	0.351*
Project team autonomy	0.743**
Informal learning	-0.667**

* Correlation is significant at the 0.05 level (1-tailed).

** Correlation is significant at the 0.01 level (1-tailed).

The findings in *Table 4.4* also reveal that there was no significant correlation between company size and growth or profitability. Similar findings are reported by Yee and Cheah (2006) in their study of 61 large construction companies from the regions of North America, Europe, and East Asia. In their report, Yee and Cheah (2006) conclude that larger companies, which are endowed with greater resources and prowess, are not guaranteed to be more profitable. However, as shown in *Table 4.6*, size had a relatively strong influence on learning competence variables. The size of a company had a positive impact on the *climate of openness* ($r = 0.427, p < 0.01$), *easy access to information* ($r = 0.351, p < 0.005$), and *project team autonomy* ($r = 0.743, p < 0.01$) and a negative impact on the intensity of *informal learning* ($r = -0.667, p = 0.01$). The latter indicates that as company size increases, the informal learning activities in the form of face-to-face interactions become less prevalent. When a company becomes larger in size and its employees are dispersed across different geographical areas, the chance for employees to come into contact with each other is reduced. Larger companies tend to be more hierarchical and formal. This claim was also supported by the correlation between age and *informal learning*. As shown in *Table 4.4*, the *informal learning* variable was negatively associated with a company's age (significant at $r = -0.458, p = 0.01$), suggesting that the older the company, the less use there is of informal learning with preference being given to formal learning.

4.2.3 *Summary and Observations*

The results of the learning assessment presented in this section show that directors/managers' assessments of their organisational learning competence did not directly correlate with the company's financial performance or with growth in company size. This was true for the overall index of organisational learning competence as well as for most of the individual criteria used to assess this overall learning competence.

The one criterion that was significantly correlated with growth was '*experimentation and innovation*' ($r = 0.534, p < 0.01$). This can be explained by a theory that associates organisational growth with exploration activities such as innovation and experimentation (March, 1991).

4.2.4 *Selecting Case Companies*

As was stated earlier, the primary purpose of this learning competence test was to rank the sample companies in terms of their organisational learning competence. The aim of the test was to establish two smaller groups of companies drawn from the highest and the lowest ranks. The top rank group, represented by six companies (20% of the total sample) that exhibited the greatest correlation with the learning competence criteria and the bottom rank group, represented by another six companies (20% of the total sample) that exhibited the least correlation with the learning competence criteria. These two groups of companies were invited to participate in the full data collection process, including company visits and interviews with managers from three different layers of the organisations, namely top management, middle management, and frontline management.

Table 4.7 ranks 30 companies according to their learning competence scores as assessed by their director or top manager.

Table 4.7
Rank of companies according to their learning competence scores

Company	Organisational learning competence criteria														Rank
	Rewards for achievement	Error toleration	Climate of openness	Freedom of speech	Inquiry and dialogue	Experimentation and innovation	Attitude towards change	Company policies	Access to Information	Personal development	Informal learning	Inter-personal and team interaction	Project team autonomy	Total Score	
6	4	4	4	5	5	4	4	5	4	5	5	5	3	57	1
10	4	4	5	5	4	4	5	5	5	4	4	4	4	57	1
25	4	4	5	5	5	5	3	4	5	5	3	5	4	57	1
30	4	3	5	5	5	3	4	5	5	5	3	5	4	56	2
3	3	3	5	5	4	3	4	5	5	5	3	5	5	55	3
18	5	4	5	5	4	4	4	5	3	4	5	5	2	55	3
27	4	4	4	4	4	4	4	5	4	4	4	5	4	54	4
2	4	3	4	4	5	4	4	4	5	4	4	4	3	52	5
9	5	3	4	5	3	3	4	4	4	4	4	4	4	51	6
23	4	4	4	4	4	5	3	3	4	4	4	4	4	51	6
8	4	3	4	5	4	4	4	4	4	4	4	3	3	50	7
20	4	3	3	4	5	4	3	3	4	5	4	5	3	50	7
7	4	3	4	4	4	4	3	3	4	4	4	5	3	49	8
13	4	4	4	4	4	4	4	4	4	3	5	3	2	49	8
15	3	3	4	5	4	4	4	4	4	4	4	4	2	49	8
29	4	3	4	4	3	5	4	4	4	4	4	3	3	49	8
5	4	3	4	4	4	3	4	5	3	3	4	3	4	48	9
11	3	4	4	5	3	4	4	4	3	3	5	3	3	48	9
12	5	3	4	4	3	3	3	3	4	4	4	4	4	48	9
16	4	3	4	4	3	3	3	3	4	5	5	3	4	48	9
17	4	3	4	4	4	4	3	4	3	4	4	4	3	48	9
19	4	3	4	4	4	3	3	3	4	4	4	4	4	48	9
1	4	3	5	4	4	3	3	3	3	5	4	4	2	47	10
14	3	2	4	5	4	3	3	4	3	4	4	4	4	47	10
22	4	4	4	4	4	4	3	3	4	4	3	3	3	47	10
4	4	4	3	4	4	4	2	2	2	5	5	4	3	46	11
26	4	2	4	4	3	3	2	4	5	4	4	4	3	46	11
24	3	2	4	4	4	3	4	4	3	4	5	4	1	45	12
21	4	2	4	4	2	3	1	3	5	3	4	5	2	42	13
28	4	1	4	4	1	4	1	3	5	3	5	4	2	41	14

Based on the company rankings as shown in *Table 4.7*, the top six companies could easily be identified and segregated from the pool of samples. However, this could not be done so easily for the bottom group because there were more than six companies with similar rankings and three companies placed in the 10th rank. In this case, Laise's (2004) ranking method for benchmarking learning organisations was used to segregate these three companies and select one of them to be included in the bottom six companies. The process of segregation as recommended by Laise (2004) is as follows.

First, the multicriteria matrix as presented in *Table 4.7* is reproduced in *Table 4.8*, highlighting the three companies that were placed in the 10th rank. This multicriteria matrix initially assumes that each criterion has the same relevance as the others; hence their weight is also equally distributed (see *Table 4.8*).

Table 4.8
Multicriteria matrix for companies in the 10th rank

	Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8	Q_9	Q_{10}	Q_{11}	Q_{12}	Q_{13}	Total score
Comp₁	4	3	5	4	4	3	3	3	3	5	4	4	2	47
Comp₁₄	3	2	4	5	4	3	3	4	3	4	4	4	4	47
Comp₂₂	4	4	4	4	4	4	3	3	4	4	3	3	3	47
Weight	1/13	1/13	1/13	1/13	1/13	1/13	1/13	1/13	1/13	1/13	1/13	1/13	1/13	

Now, a comparison of $Comp_1$ with $Comp_{14}$ using the values in Table 4.8, shows evidently that $Comp_1$ is better than or equal (weak preferred) to $Comp_{14}$ for 10 criteria out of 13. That is:

$$\begin{aligned}
 Q_1 (Comp_1) = 4 &\geq Q_1 (Comp_{14}) = 3, \\
 Q_2 (Comp_1) = 3 &\geq Q_2 (Comp_{14}) = 2, \\
 Q_3 (Comp_1) = 5 &\geq Q_3 (Comp_{14}) = 4, \\
 Q_5 (Comp_1) = 4 &\geq Q_5 (Comp_{14}) = 4, \\
 Q_6 (Comp_1) = 3 &\geq Q_6 (Comp_{14}) = 3, \\
 Q_7 (Comp_1) = 3 &\geq Q_7 (Comp_{14}) = 3, \\
 Q_9 (Comp_1) = 3 &\geq Q_9 (Comp_{14}) = 3, \\
 Q_{10} (Comp_1) = 5 &\geq Q_{10} (Comp_{14}) = 4, \\
 Q_{11} (Comp_1) = 4 &\geq Q_{11} (Comp_{14}) = 4, \\
 Q_{12} (Comp_1) = 4 &\geq Q_{12} (Comp_{14}) = 4.
 \end{aligned}$$

Ten criteria {1, 2, 3, 5, 6, 7, 9, 10, 11, 12} agree in considering $Comp_1$ better than or equal to $Comp_{14}$, whilst only nine criteria {4, 5, 6, 7, 8, 9, 11, 12, 13} consider $Comp_{14}$ better than or equal to $Comp_1$. That is:

$$\begin{aligned}
 Q_4 (Comp_{14}) = 5 &\geq Q_4 (Comp_1) = 4, \\
 Q_5 (Comp_{14}) = 4 &\geq Q_5 (Comp_1) = 4, \\
 Q_6 (Comp_{14}) = 3 &\geq Q_6 (Comp_1) = 3, \\
 Q_7 (Comp_{14}) = 3 &\geq Q_7 (Comp_1) = 3, \\
 Q_8 (Comp_{14}) = 4 &\geq Q_8 (Comp_1) = 3, \\
 Q_9 (Comp_{14}) = 3 &\geq Q_9 (Comp_1) = 3,
 \end{aligned}$$

$$\begin{aligned}
Q_{11} (Comp_{14}) &= 4 \geq Q_{11} (Comp_1) = 4, \\
Q_{12} (Comp_{14}) &= 4 \geq Q_{12} (Comp_1) = 4, \\
Q_{13} (Comp_{14}) &= 4 \geq Q_{13} (Comp_1) = 2.
\end{aligned}$$

Repeating the same procedure for all the other pairs of companies produced *Table 4.9* as follows.

Table 4.9
Matrix of concordance subsystems (J^c)

	<i>Comp₁</i>	<i>Comp₁₄</i>	<i>Comp₂₂</i>
<i>Comp₁</i>		{1,2,3,5,6,7,9,10,11,12}	{1,3,4,5,7,8,10,11,12}
<i>Comp₁₄</i>	{4,5,6,7,8,9,11,12,13}		{3,4,5,7,8,10,11,12,13}
<i>Comp₂₂</i>	{1,2,4,5,6,7,8,9,13}	{1,2,3,5,6,7,9,10}	

The generic element $J^c(Comp_i, Comp_j)$ of the matrix of *Table 4.9* is given by:

$$J^c(Comp_i, Comp_j) = \{j \in J / G_j(Comp_i) \geq G_j(Comp_j)\}$$

where, $J = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13\}$

Taking into account the weights assigned to the various criteria (see *Table 4.8*), a concordance index could be computed for each pair of companies ($Comp_i, Comp_j$):

$$C(Comp_i, Comp_j) = \sum_{j \in J^c} K_j$$

where, K_j is the weight assigned to the j th criterion.

For example, for the pair ($Comp_1, Comp_{14}$), its concordance index is:

$$\begin{aligned}
C(Comp_1, Comp_{14}) &= K_1 + K_2 + K_3 + K_5 + K_6 + K_7 + K_9 + K_{10} + K_{11} + K_{12} \\
&= 1/13 + 1/13 + 1/13 + 1/13 + 1/13 + 1/13 + 1/13 + 1/13 + 1/13 + 1/13 \\
&= 0.77 \text{ (77\%)}
\end{aligned}$$

This means that one could have a majority of criteria of 77% in favour of *Comp₁* with respect to *Comp₁₄*. Repeating the same procedure for the other pairs of companies produced the concordance matrix of *Table 4.10* below.

Table 4.10
Concordance matrix

	<i>Comp₁</i>	<i>Comp₁₄</i>	<i>Comp₂₂</i>
<i>Comp₁</i>		0.77	0.69
<i>Comp₁₄</i>	0.69		0.69
<i>Comp₂₂</i>	0.69	0.62	

The concordance indicator in *Table 4.10* varies between 0 and 1. It is equal to 1 only if there is unanimity or if the majority of the criteria are 100% in favour of *Comp_i* with respect to *Comp_j*. As explained by Laise (2004), in order to decide on the superiority of one company with respect to another, the decision maker should set a concordance threshold C^* . Generally, it is chosen to be a majority greater than 50% (simple majority), that is $C^* > 0.5$ (50%). However, for the purpose of this assessment, the concordance test was tightened with a C^* value of ≥ 0.65 (65%).

Taking into account the database of *Table 4.10* and the concordance threshold $C^* \geq 0.65$, the following concordance test was applied:

$$T_C(Comp_i, Comp_j) = \begin{cases} 1 & \text{if } C(Comp_i, Comp_j) > C^* \\ 0 & \text{if otherwise} \end{cases}$$

The results of the concordance test are shown in *Table 4.11*.

Table 4.11
Outcomes of concordance test

	<i>Comp₁</i>	<i>Comp₁₄</i>	<i>Comp₂₂</i>
<i>Comp₁</i>		1	1
<i>Comp₁₄</i>	1		1
<i>Comp₂₂</i>	1	0	

The result of the concordance test as presented in *Table 4.11* clearly shows that *Comp₂₂* was the least superior in comparison with the other two companies (*Comp₁* and *Comp₁₄*). Therefore, it was safe to include Company 22 in the group of six companies that exhibited least correlation with learning competence criteria.

Tables 4.12 and *4.13* highlight the general attributes of the group of companies that exhibited the greatest correlation with the organisational learning competence criteria and the group of companies that had the least correlation with the criteria respectively.

Table 4.12
General attributes of the high learning companies

<i>Rank</i>	<i>Pseudonym of company</i>	<i>Main area of contracting activities</i>	<i>Total score</i>	<i>Size (No. employees)</i>	<i>Years in business</i>	<i>Assigned ID</i>
1	Comp6	General building	57	200	100	Company A
1	Comp10	Specialty M/E	57	4.000	86	Company B
1	Comp25	Multidiscipline	57	22.000	159	Company C
2	Comp30	General building	56	1.800	104	Company D
3	Comp3	Multidiscipline	55	24.000	104	Company E
3	Comp18	Specialty glazing	55	200	25	Company F

Table 4.13
General attributes of the low learning companies

<i>Rank</i>	<i>Pseudonym of company</i>	<i>Main area of contracting activities</i>	<i>Total score</i>	<i>Size (No. employees)</i>	<i>Years in business</i>	<i>Assigned ID</i>
10	Comp22	General building	47	13.500	98	Company G
11	Comp4	General building	46	90	7	Company H
11	Comp26	Specialty M/E	46	1.400	191	Company I
12	Comp24	Specialty Ceiling	45	100	24	Company J
13	Comp21	Specialty Water	42	250	23	Company K
14	Comp28	Spec Instrumentation	41	400	87	Company L

A Mann-Whitney U test for independent samples was used to compare the difference between the average scores of the above two groups of companies. The result was significant at $p < 0.01$, suggesting a substantial difference between the two. Furthermore, the differences between the individual criterion scores were mostly significant as well, except the (1) *reward for achievement*, (2) *experimentation and innovation*, (3) *easy access to information*, and (4) *informal learning* criteria.

4.2.5 Gap Analysis on Company Learning

Learning gap analysis was conducted to further identify the strengths and weaknesses of both groups in terms of their average level of learning. By comparing the gap levels between the two groups, it was possible to mark those areas that made them different and those areas that they had in common. The average learning gap was obtained from the difference between the highest learning score (= 5 or 100%) and the mean score on learning competence criteria, given in percentage terms. This can be represented by the following equations:

$$\text{Gap} = \frac{(\Phi - \text{Mean})}{\Phi}$$

$$\text{Mean} = \frac{1}{n}(x_i + \dots + x_j)$$

Where:

Φ = the highest score in the learning competence test (in this case is 5 or 100%);

n = total number of companies in the group (in this case is 6);

x_i = the score given to Company i for a given criterion (refer to *Table 4.7*);

x_j = the score given to Company j for a given criterion (refer to *Table 4.7*).

Applying the above formula to both groups of companies using the learning competence scores provided in *Table 4.7* produced two separate graphs as presented in *Figures 4.15* and *4.16*. The dark areas in the graphs represent the level of gaps of a given criterion.

Figure 4.15
Learning gaps for the high performer group

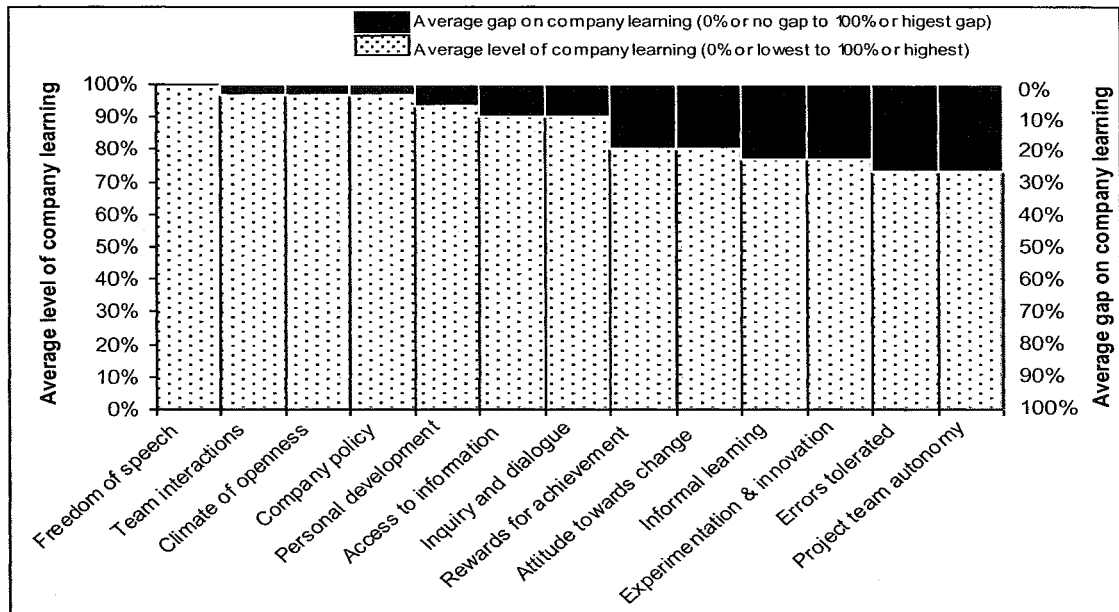
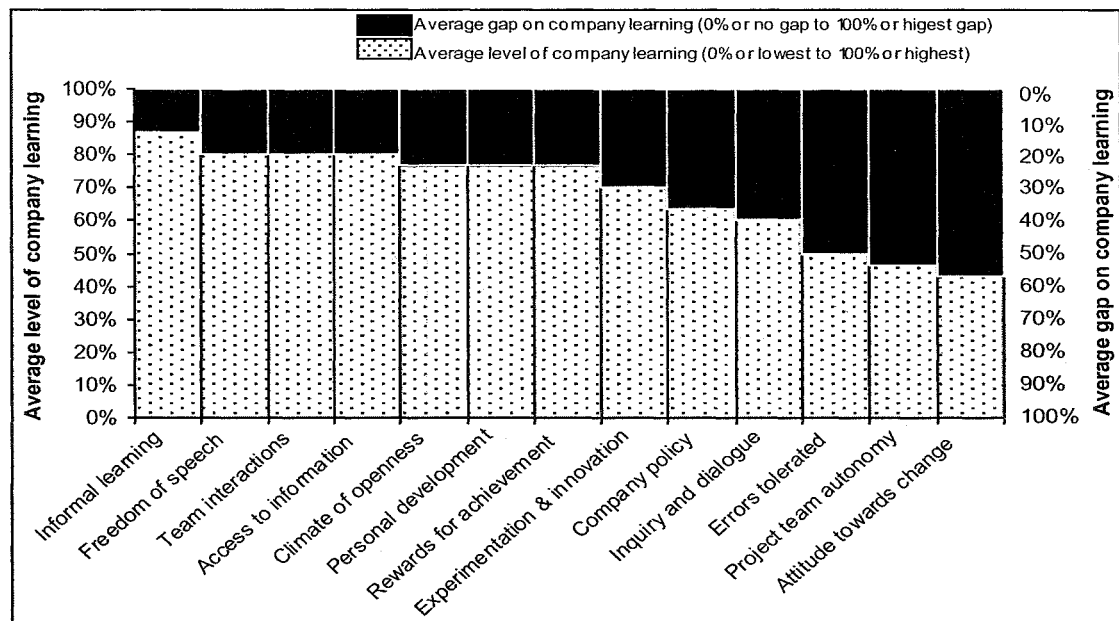


Figure 4.16
Learning gaps for the low performer group



With reference to the graphs in *Figures 4.15* and *4.16* above, it can be observed that in general, the gap difference between the two groups of companies is obvious (compare the dark areas in both graphs). As expected, the lower performing group tended to have a deeper gap in their overall learning than that of the higher performing group. However, a further analysis at each individual criterion revealed that there were some

instances where the differences between the higher and lower groups were only marginal, such as evidenced in *access to information*, *reward for achievement*, *informal learning*, and *experimentation and innovation* criteria. In these four criteria, their mean differences were actually insignificant as noted earlier. Arguably, this can be explained by the fact that all companies from both groups were actually active members of *Constructing Excellence*. Therefore, it is very probable that even the lowest scores in organisational learning competence criteria were not necessarily the lowest performers among the North East construction companies.

4.3 Chapter Conclusions

The primary purpose of developing this chapter was two-fold: to demonstrate the methods used for the selection of credible samples for the research, and to establish the business context for the samples. This was achieved through the business environment audit and the learning competence test. Using the latter, two groups of companies – each consisting of six companies – were selected and were involved in the full data collection stage involving a model development process as will be reported in the next chapter (Chapter 5). The first group represented the high learning companies, that is, those that exhibited the greatest correlation with the organisational learning competence criteria, and the second group represented the low learning companies, that is, those that exhibited the least correlation with the criteria.

In addition, as part of the analysis process, the data from the learning competence test revealed some interesting findings about the correlation between some learning competence criteria and company growth and size, all of which was stipulated in the hypotheses.

5. Full Data Collection and Model Development

A theory has only the alternative of being wrong. A model has a third possibility: it might be right but irrelevant.

-Manfred Eigen (1927)

Following a first stage data collection and sample validation reported in Chapter 4, the present chapter reports on the process and results of a fuller data collection involving respondents from three different organisational layers. Twelve companies were closely studied in order to model their organisational learning profiles with regard to the application of various learning mechanisms set out in the conceptual framework. Six companies were selected from the highest achievers in the learning competence test and another six were from the lowest scorers in the test.

The chapter begins with an overview of the methodology used in the data collection and analysis process, followed by a presentation of results in Section 5.2. Section 5.3 deals with the model development process involving modelling the practices of knowledge acquisition, knowledge sharing, and knowledge retention. A pattern-matching analysis of organisational learning profiles is developed in Section 5.4, including an analysis of selected best practice models. The chapter concludes with an account of the process and the results of model evaluation in Section 5.5.

5.1 Overview of Methodology

A total of 72 structured interviews with managers of construction companies were conducted in the full data collection stage. There were six interviewees from each company – one interviewee from top management, two from middle management, and three from frontline management levels. The composition of research participants and their positions in the organisations are presented in *Table 5.1*. The interviews focused on the dynamic applications of learning mechanisms underlying the framework established in Chapter 3. The structured interviews lasted between thirty minutes and

one hour. In addition, information derived from companies' annual reports that documented their activities was used to complement and support the primary data from interviews.

Table 5.1
Composition of participants in the primary study phase

<i>No. of companies involved</i>	<i>No. of participants</i>	<i>No. of interviews conducted</i>	<i>Participants and their position in the organisation</i>
12	72 (6 in each organisation)	72	12 Top managers 24 Middle managers 36 Frontline managers

5.1.1 Sample Selection

Cook and Campbell (1979) suggest the use of random samples from the same population for theory testing research. However, the sample selected for a mixed research such as in this study should be purposeful, as suggested by Miles and Huberman (1994). Furthermore, the goal of the research was not to represent the generic model of a larger population at industry level but rather to establish a typology of practices by individual excellent companies as best practice models.

To achieve this goal, the first step was to identify construction companies located in North East England that engaged in various performance improvement programmes. Such organisations were notably found in the members of *Constructing Excellence*. The ultimate number of companies selected reflects considerations such as company size (> 50 employees) and the accessibility of targeted management personnel (6 managers in different organisational layers). With the help of the *North East Constructing Excellence* office, 100 companies were identified as prospective sample companies. Next, part of the sample validation procedure involved a data collection in the form of the business environment audit and the learning competence test. From the former, a comparable group of 30 companies was identified and through the latter, two smaller groups – each consisting of 6 sample companies – were selected from the original sample population of 30 companies. A full data collection was then conducted in these two groups of companies from which the main arguments and the empirical model in this thesis were developed.

5.1.2 Data Collection

A full data collection was conducted using structured and open-ended interviews in a company setting. Twelve companies were visited at their head office or regional office located in Newcastle upon Tyne, Gateshead, and the Northumberland area.

At the initial stage, interviews were conducted with the top manager of each company following the previous contact in the first stage data collection process. At the end of each interview, the top manager was requested to provide a list of personnel who held a position similar or equal to that of a contract/project manager and a site manager in their office. Two contract/project managers and three site managers were then selected randomly and interviewed separately. The process of data collection followed a strict interview protocol (see *Appendix 3*). Notes were taken to identify the responses to all of the protocol questions. Moreover, additional telephone interviews were undertaken at a later stage in the event of information being found to be missing or incomplete.

5.1.3 Data Analysis

Data analysis methods in this stage were both quantitative and interpretative. The former refers to the use of statistical data analysis techniques and the latter uses pattern-matching analysis methods. The main components of data analysis included within group, across group, and across case analyses. As recommended by Yin (1994), within group analysis helps examine the practice of organisational learning in a similar context, whilst the across group and across case analyses serve as a form of replication, where the constructs of interest in one setting are tested in other settings. In effect, the models that emerged from the high learning group were then tested against the practice in the low learning group.

The key analysis instruments and presentation tools used to facilitate data interpretation were: (1) mean scores, (2) statistical tests, (3) matrices, (4) tabulations, (5) bar-charts, and (6) radar diagrams. Each has been briefly discussed in the corresponding sections that concern the analysis.

5.2 Results

The results of the primary data collections are presented in the following sections. First, the results of the managers' assessments of the various learning mechanisms are presented in such a way as to allow a comparison to be made between the company groups. The presentation is structured according to the questions asked in the primary data collection phase. Next, the aggregated results of each company are presented to allow further analysis and comparison to be made between individual companies as well as groups of companies and between different learning mechanisms. The last sections of the presentation of results take the form of best cases analysis to recount the learning practice of excellent companies. This allows some qualitative data to be incorporated into the accounts as part of the full research findings.

5.2.1 Results of External Knowledge Acquisition Mechanisms

The results of the managers' assessment of the use of the four external learning mechanisms in their company are provided in the following sections. Short comparative analyses between groups are provided for each learning mechanism based on the descriptive statistics that resulted from the data and the results of the Mann-Whitney *U*-test for equality of means.

Use of Project Teams as Learning Sensors

To what extent does your company facilitate the project teams to function as learning sensors against the external world?

The results of this question are presented in *Table 5.2*.

Table 5.2
The extent of the use of project teams as learning sensors

	<i>To a very great extent (4)</i>	<i>To a large extent (3)</i>	<i>To a moderate extent (2)</i>	<i>To a small extent (1)</i>	<i>Not at all (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	15	10	4	4	3	2.83	1.32
Low learning companies	9	13	8	6	0	2.69	1.03

Responses to this question vary greatly among managers, especially those from the high learning companies (std. dev. = 1.32). A separate analysis is provided in the other part of this chapter to see whether the disagreement was due predominantly to differing company characteristics or to differences among the respondent groups. Whilst 15 managers claimed their companies ‘to a very great extent’ encouraged their *project teams to function as learning sensors*, three other managers claimed the opposite, noting their companies did ‘not at all’ facilitate their project teams to support external learning. As shown in *Table 5.2*, the situation with the low learning group was only a little better (std. dev. = 1.03). The mean difference between the groups is too small to reach significance (the Mann-Whitney *U*-test of independent samples, $p > 0.05$). Overall, both the high learning group and the low learning group rated their companies as using *project teams to function as learning sensors* ‘to a large extent’ (means = 2.83 and 2.69, respectively).

Use of Marketing Divisions to Learn the Markets

To what extent does your company facilitate the use of the marketing division to continuously monitor and learn the situation in the market?

The responses to this question are presented in *Table 5.3*.

Table 5.3
The extent of the use of marketing division to learn the markets

	<i>To a very great extent (4)</i>	<i>To a large extent (3)</i>	<i>To a moderate extent (2)</i>	<i>To a small extent (1)</i>	<i>Not at all (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	17	7	8	4	0	3.03	1.08
Low learning companies	13	11	10	2	0	2.97	0.94

Table 5.3 shows the distribution of responses by their frequencies and group category. The result demonstrates that there is only a little difference between the mean score of the high learning group (mean = 3.03) and that of the low learning group (mean = 2.97). Overall, construction companies from both groups *used the marketing division to learn the markets* ‘to a large extent’.

Use of Special Expertise to Scan Outside World

To what extent does your company employ special expertise or buy ready-made knowledge as part of the company's external learning strategies?

The results of this question are presented in Table 5.4.

Table 5.4
The extent of the use of special expertise to scan outside world

	<i>To a very great extent (4)</i>	<i>To a large extent (3)</i>	<i>To a moderate extent (2)</i>	<i>To a small extent (1)</i>	<i>Not at all (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	8	17	6	0	5	2.64	1.25
Low learning companies	0	8	16	4	8	1.67	1.07

Responses to this question vary greatly (std. dev. = 1.25 and 1.07) and the mean difference between the two groups is significant at $p = 0.001$. Table 5.4 suggests that the *use of special expertise* to scan the outside world is a less common practice among the majority of construction companies than the other three external learning mechanisms. This is especially evident in the low learning group. Only eight (22%) managers of high learning companies claimed their company 'to a very great extent' employed *special expertise* as part of the company's external learning efforts.

Use of Benchmarking

To what extent does your company use benchmarking to learn from competitor performance?

The results of this question are presented in Table 5.5.

Table 5.5
The extent of the use of benchmarking to learn from competitors

	<i>To a very great extent (4)</i>	<i>To a large extent (3)</i>	<i>To a moderate extent (2)</i>	<i>To a small extent (1)</i>	<i>Not at all (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	21	9	2	3	1	3.28	1.08
Low learning companies	21	6	3	3	3	3.08	1.34

The result of this question (see *Table 5.5*) is similar to that of other external learning mechanisms in that a relatively high degree of variation occurs among assessors (std. dev. = 1.08 and 1.34). Overall, managers noted their company ‘to a large extent’ used *benchmarking to learn from competitor performance* (means = 3.28 and 3.08). The difference between the means is too small to be statistically significant (obtained *p* value > 0.05).

5.2.2 Results of Internal Knowledge Acquisition Mechanisms

This section presents the results of managers’ assessment regarding the use of the four internal learning mechanisms in their company. In general, the rates of internal learning mechanisms tend to be higher than those of the external learning mechanisms discussed in the previous sections. This gives the impression that, to some extent, construction companies tend to place more emphasis on exploiting their internal knowledge than on exploring external knowledge, as was the case in this research.

Use of Quality Circles

To what extent does your company use quality circles as part of internal organisational learning activities?

The results of this question are presented in *Table 5.6*.

Table 5.6
The extent of the use of quality circles as part of internal organisational learning activities

	<i>To a very great extent (4)</i>	<i>To a large extent (3)</i>	<i>To a moderate extent (2)</i>	<i>To a small extent (1)</i>	<i>Not at all (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	15	8	9	4	0	2.94	1.06
Low learning companies	12	15	4	3	2	2.89	1.14

Overall, managers from the two groups of companies noted that their companies ‘to a large extent’ (means = 2.94 and 2.89) used *quality circles* as part of the internal organisational learning activities. There is only a minor difference between the mean of

the high learning group and the mean of the low learning group (see *Table 5.6*). A Mann-Whitney *U*-test of independent samples for equality of means confirms this at an obtained value $p = 0.897 > 0.05$, meaning that the difference are not statistically significant. However, two respondents from the low learning companies claimed their company did ‘not at all’ use *quality circles*. As a result, the variation among rates from the low learning group is higher (std. dev. = 1.14) than among the high learning group (std. dev. = 1.06).

Use of Project Reviews

To what extent does your company use project reviews to support organisational learning?

The results of this question are presented in *Table 5.7*.

Table 5.7
The extent of the use of project reviews to support organisational learning

	<i>To a very great extent (4)</i>	<i>To a large extent (3)</i>	<i>To a moderate extent (2)</i>	<i>To a small extent (1)</i>	<i>Not at all (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	36	0	0	0	0	4.00	0.00
Low learning companies	34	2	0	0	0	3.94	0.23

As shown in *Table 5.7*, the means for this learning mechanism are higher than the mean for any other learning mechanism. All 36 managers from the high learning companies agreed in their assessment that their company practised *project reviews* ‘to a very great extent’ (mean = 4.00). Thirty-four (94%) managers from the low learning companies claimed their company practised a *project review* mechanism ‘to a great extent’ (mean = 3.94). This indicates that a *project review* mechanism is a common practice among the construction companies, regardless of their overall learning competencies. The mean difference between the groups is not significant.

Use of Lessons Learned from Project Failures

To what extent does your company facilitate the use of lessons learned from project failures to improve subsequent projects?

The results of this question are presented in Table 5.8.

Table 5.8
The extent of the use of lessons learned from project failures to improve subsequent projects

	<i>To a very great extent (4)</i>	<i>To a large extent (3)</i>	<i>To a moderate extent (2)</i>	<i>To a small extent (1)</i>	<i>Not at all (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	33	3	0	0	0	3.92	0.28
Low learning companies	32	4	0	0	0	3.89	0.32

The means for this learning mechanism are also relatively high for both groups (means = 3.92 and 3.89) with a very small variation only (std. dev. = 0.28 and 0.32). Thirty-three (92%) and 32 (89%) managers from the high learning companies and the low learning companies, respectively, assessed their company as using the *lessons learned from project failures* 'to a very great extent' (see Table 5.8). The mean difference between the two groups is insignificant ($p = 0.693 > 0.05$).

Use of Lessons Learned from project Successes

To what extent does your company use the lessons learned from project successes to improve the overall organisational performance?

The results of this question are presented in Table 5.9.

Table 5.9
The extent of the use of lessons learned from project successes to improve the overall organisational performance

	<i>To a very great extent (4)</i>	<i>To a large extent (3)</i>	<i>To a moderate extent (2)</i>	<i>To a small extent (1)</i>	<i>Not at all (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	34	2	0	0	0	3.94	0.23
Low learning companies	32	3	1	0	0	3.86	0.42

The result of this question is similar to that of the previous question. As depicted in *Table 5.9*, the means for using *lessons learned from project successes* are also relatively high for both groups (means = 3.94 and 3.86). Thirty-four (94%) and 32 (89%) managers from the high learning companies and the low learning companies, respectively, assessed their company as using the *lessons learned from project successes* ‘to a very great extent’. Again, the difference between the means of the two groups is insignificant ($p > 0.05$).

5.2.3 Results of Informal Knowledge Sharing Mechanisms

This section presents the results of managers’ assessments of their practices or involvement with the various activities that characterise the use of informal knowledge sharing mechanisms.

Social Meetings and Informal Gatherings

How often do you take the opportunity to share knowledge in a social meeting or informal gathering?

The results of this question are presented in *Table 5.10*.

Table 5.10
Frequencies of using social activities and informal gatherings for sharing knowledge

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	6	16	14	0	0	2.78	0.72
Low learning companies	11	7	14	4	0	2.70	1.04

As shown in *Table 5.10*, the mean difference between the two groups is too small to be significant ($p > 0.05$). Overall, the frequencies of the *use of social activities and informal gatherings* range from ‘sometimes’ to ‘always’ (means = 2.78 and 2.70). This indicates that, in general, the environment of the construction companies seem quite supportive of informal knowledge sharing through the medium of socialisation. Nevertheless, the extent to which such opportunities are available may vary between companies due to company size and the geographical dispersion of companies’

operations. As was hypothesised in Chapter 3 (hypothesis 5), a smaller and collocated company seems more likely to base its knowledge sharing practices on informal mechanisms such as face-to-face *social interaction and informal gatherings*.

Personal Networking

How often do you use your personal networks for the exchange of knowledge or experiences that relate to your work?

The results of this question are presented in *Table 5.11*.

Table 5.11
Frequencies of using personal networking for the exchange of knowledge or experiences

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	16	12	7	1	0	3.19	0.85
Low learning companies	9	5	17	5	0	2.50	1.03

The mean score of the *use of personal networking* is considerably higher in the high learning company group (mean = 3.19) than in the low learning company group (mean = 2.50). This mean difference is statistically significant at an obtained *p* value = 0.003, meaning that one can claim with 99.7% confidence that this result did not simply occur by chance.

As shown in *Table 5.11*, the largest proportion of respondents from the high learning companies claimed they ‘always’ (44%) and ‘often’ (33%) *used personal networks* for the exchange of knowledge or experiences related to their work. On the contrary, almost half of the respondents (47%) from the low learning companies claimed only that they ‘sometimes’ *used their personal networks* for knowledge sharing.

Informal Storytelling Sessions

How often are you involved in an informal storytelling session where you can share learning with others?

The results of this question are presented in *Table 5.12*.

Table 5.12
Frequencies of using informal storytelling sessions to share learning

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	12	11	9	4	0	2.86	1.02
Low learning companies	10	5	19	2	0	2.64	0.96

Managers from both the high and the low learning companies all claimed, with varying frequencies, that they were involved in *informal storytelling sessions* as part of the practice of sharing learning in the work place. The mean scores of the use of this knowledge sharing mechanism are 2.86 and 2.64 for the high and the low learning companies respectively (see *Table 5.12*). The difference between the means is too small to reach significance ($p = 0.286$).

Onsite Information Exchange

How often are you involved in the practice of sharing or exchanging information with your project team members?

The results of this question are presented in *Table 5.13*.

Table 5.13
Frequencies of information exchange between project team members

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	17	16	3	0	0	3.39	0.64
Low learning companies	21	11	4	0	0	3.47	0.70

The means of this learning mechanism are very close (means = 3.39 and 3.47) and the variation among rates is quite small (std. dev. = 0.64 and 0.70). *Table 5.13* shows that all managers at least ‘sometimes’ were involved in information exchange activities. The large majority of managers in both groups claimed they were ‘always’ or ‘often’ involved in *sharing or exchanging information* with their project team members. Evidently, this finding suggests that *information exchange* is practically a norm in the daily business of the construction companies. Such practices can take place informally, either through face-to-face verbal communication, the exchange of electronic files or paper documents, or through telephone conversations. At the project site level, this kind of knowledge sharing mechanism can be seen in activities such as the exchange of project documents – scheduling, cost control, quality assurance, *etc.* – between project members. Shohet and Laufer (1991) found that construction foremen spent over 50% of their communication time exchanging information about work methods.

Exchange of Personal Notes

How often are you involved in the practice of exchanging personal notes for sharing knowledge with your colleagues?

The results of this question are presented in *Table 5.14*.

Table 5.14
Frequencies of using personal notes to share knowledge with colleagues

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	11	4	4	13	4	2.14	1.48
Low learning companies	19	9	4	3	1	3.17	1.11

Interestingly, the results from this question show that the people from the low learning companies used *personal notes* more frequently than did the people from the high learning companies (*Table 5.14*). The mean difference is highly significant ($p = 0.001$). Further analysis of the use of *personal notes* as a medium for informal knowledge sharing in each individual company is presented in the later sections.

Voluntary Case Writings

How often do you share your written reflections about a project or task of which you have experience?

The results of this question are presented in *Table 5.15*.

Table 5.15
Frequencies of using voluntary case writings to share experiences

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	10	2	13	9	2	2.25	1.27
Low learning companies	20	11	5	0	0	3.42	0.73

As with the use of *personal notes*, the mean scores of the use of *case writings* in the high learning company group tends to be weaker than in the low learning company group (means = 2.25 and 3.42, respectively). The mean difference is obviously significant ($p = 0.001$). A more detailed analysis of this knowledge sharing mechanism will be provided elsewhere in this chapter.

5.2.4 Results of Formal Knowledge Sharing Mechanisms

Questions in this section asked managers to rate their frequencies of practices or involvement in relation to six activities that characterise the use of formal knowledge sharing mechanisms. The responses to each question are presented in the following section.

Formalised Communities of Practices

How often are you involved in the practice of sharing information or exchanging experiences with people you know share an interest related to your job?

The results of this question are presented in *Table 5.16*.

Table 5.16
Frequencies of using formalised communities of practices to share information or exchange experiences

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	17	12	7	0	0	3.28	0.78
Low learning companies	11	11	9	5	0	2.78	1.05

A significant difference in responses between the two groups is evidenced in this question ($p = 0.042$). The mean score for the high learning group is 3.28, whilst the mean score for the low learning group is 2.78 (see Table 5.16). All managers claimed that they were involved in the knowledge sharing activities through their *communities of practices* to varying degrees. Seventeen (47%) and 11 (31%) managers from the high and the low learning groups, respectively, ‘always’ turned to the people they knew shared a professional interest when they needed to share or exchange information related to their work. This gives a strong indication that people in the high learning companies are more active in knowledge sharing activities than are people from the low learning companies.

Inter-project Visits

How often do you promote or become involved in an inter-project visit to learn or share experiences?

The results of this question are presented in Table 5.17.

Table 5.17
Frequencies of using inter-project visit schemes to learn or share experiences

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	19	10	7	0	0	3.33	0.79
Low learning companies	10	18	4	4	0	2.94	0.92

The results of this question are similar to those of the previous question (compare with *Table 5.16*). The mean difference between groups is significant at $p < 0.05$. As with the *communities of practice* mechanism, the *inter-project visit mechanism* was supported by all managers in both company groups (see *Table 5.17*). All managers of high learning companies at least ‘sometimes’ promoted or were involved in knowledge sharing activities through inter-project visit schemes. More than half (53%) of the managers from this company group ‘always’ involved in this formal mechanism of sharing knowledge. Thus, there is indicative evidence that people from the high learning companies are more active in promoting or engaging in knowledge sharing activities such as the *inter-project visit* mechanism. The advantage of such a mechanism is its ability to disseminate the lessons learned during a project to other project teams within the same organisation whilst the experience is still fresh in employees’ minds.

Use of Intranets

How often do you use intranets to search, send, store, and exchange information and to share knowledge?

The results of this question are presented in *Table 5.18*.

Table 5.18
Frequencies of using intranets to search, send, store, and exchange information

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	23	1	4	8	0	3.08	1.29
Low learning companies	22	3	5	4	2	3.08	1.32

As shown in *Table 5.18*, the means of this learning mechanism are similar (means = 3.08 and 3.08), but the degree of disagreement among respondents within each group is considerably high (std. dev. = 1.29 and 1.32), probably due to differences in company origin rather than in the respondents’ role. Twenty-three (64%) managers from the high learning companies claimed that they ‘always’ used intranets for searching, sending, storing and exchanging information related to their work. Similarly, 22 (61%) managers from the low learning companies noted they ‘always’ used intranets. However, two

(6%) respondents from the low learning company group claimed they ‘never’ *used intranets* to search, share, store, and exchange information related to their work. Further analysis regarding the use of intranets by each individual company is provided elsewhere in this thesis.

Overall, the *use of intranets* for sharing knowledge is a common practice in most of the construction companies, regardless of their overall learning competencies. The differing degrees of use may be explained by the size of the company. As was hypothesised in Chapter 3, a larger and more geographically dispersed company would be more likely to exploit the use of formal knowledge sharing mechanisms such as intranets.

Company Newsletters

How often do you use company newsletters to update your knowledge or provide information to others?

The results of this question are presented in *Table 5.19*.

Table 5.19
Frequencies of using company newsletters to update knowledge or spread information

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	24	4	5	3	0	3.36	1.02
Low learning companies	21	9	1	5	0	3.28	1.06

The use of *company newsletters* as a formalised medium for knowledge sharing scores equally high frequencies in both company groups. Twenty-four (67%) and 21(58%) managers from the high and the low learning companies, respectively, claimed that they ‘always’ use the *company newsletter* to update their knowledge as well as to provide information to other employees.

Overall, the practice of exploiting *company newsletters* for spreading information within the company is very common in the construction companies involved in the present study. The mean scores are recorded at 3.36 and 3.28 for the high and the low

learning company groups, respectively (*Table 5.19*). The difference between means is not significant at $\alpha = 0.05$. A mention of the use of newsletters as one alternative venue for knowledge sharing in construction companies is reported by Egbu *et al.* (2005).

Lessons Learned Databases

How often do you use lessons-learned databases to solve the problems you encounter?

The results of this question are presented in *Table 5.20*.

Table 5.20
Frequencies of using lessons learned databases to source knowledge

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	24	9	3	0	0	3.58	0.65
Low learning companies	23	13	0	0	0	3.64	0.49

A relatively high agreement among managers is achieved in the answers to this question (std. dev. = 0.65 and 0.49). *Table 5.20* shows that 24 (67%) and 23 (64%) managers from the high and the low learning companies, respectively, claimed they ‘always’ used their company’s *lessons learned databases* to share and source knowledge related to their work. All other managers, except three, declared that they ‘often’ used their company’s *lessons learned databases*.

The finding from this question suggests that the use of *lessons learned databases* to support knowledge sharing in the construction companies involved in the present study is a normal practice, regardless of the category of their learning competencies. According to Fong and Yip (2005), by installing *lessons learned databases* in construction, professionals can learn from lessons from past projects and share their knowledge or experience to create new lessons learned.

Standardisation of Methods and Best Practices

How often are you involved in the practice of using or promoting standard methods or practices in doing your specific tasks?

The results of this question are presented in *Table 5.21*.

Table 5.21
Frequencies of using standardisation of methods and best practices

	<i>Always</i> <i>(4)</i>	<i>Often</i> <i>(3)</i>	<i>Sometimes</i> <i>(2)</i>	<i>Rarely</i> <i>(1)</i>	<i>Never</i> <i>(0)</i>	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	24	7	2	3	0	3.46	0.95
Low learning companies	27	3	6	0	0	3.58	0.77

The means of this formal knowledge sharing mechanism are almost as high as in the *lessons learned databases* and the mean difference is not significant. As shown in *Table 5.21*, 24 (67%) and 27 (75%) managers from the high and the low learning companies, respectively, claimed that they were ‘always’ required to utilise their company’s *standard methods and best practices* in doing their specific tasks.

Again, the finding from this question suggests a common practice of the *standardisation of methods and best practices* in the construction companies. This finding is particularly supportive of the existing literature, which suggests that the practice of using the *standardisation of methods and best practices* for construction works is a normal practice of construction companies (Batik, 1989; Bennett, 2000).

5.2.5 Results of Personalisation Mechanisms

Overall, the results of knowledge retention questions are very consistent with the results of knowledge sharing questions regarding the same learning mechanism. This strengthens the assumption that the answer to each individual question had been thoughtfully given by respondents, not simply by a random chance.

Use of Stories

How often do you tell a story to your colleagues to convey a message that relates to your work?

The results of this question are presented in Table 5.22.

Table 5.22
Frequencies of using stories for knowledge retention

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	12	11	9	4	0	2.86	1.01
Low learning companies	9	6	19	2	0	2.61	0.93

There is a small difference only in the means between the groups (2.86 and 2.61), therefore insignificant ($p = 0.229$). All managers made use of *stories* at varying frequencies from 'rarely' to 'always'.

Personal Networks

How often do you rely on your personal networks to keep yourself updated with information or developments that relate to your work?

The results of this question are presented in Table 5.23.

Table 5.23
Frequencies of using personal networks for knowledge retention

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	17	11	7	1	0	3.22	0.87
Low learning companies	9	5	17	5	0	2.50	1.03

In this learning mechanism, the mean difference between the groups is highly significant ($p = 0.003$). Managers from the high learning companies tend to be more actively engaged with their *personal networks* than those from the low learning companies (means = 3.22 and 2.50, respectively).

Social Meetings and Informal Gatherings

How often do you engage in social meetings and informal gatherings to make yourself aware of what is going on in your work related issues?

The results of this question are presented in Table 5.24.

Table 5.24
Frequencies of using social meetings and informal gatherings for knowledge retention

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	6	18	12	0	0	2.83	0.70
Low learning companies	11	7	14	4	0	2.69	1.04

The mean difference of the groups is not quite significant at $\alpha = 0.05$. All the managers of the high learning companies were at least 'sometimes' participated in *social meetings or informal gatherings*. There were four managers from the low learning companies who claimed they were 'rarely' involved in the *social meetings or informal gatherings*.

Communities of Practices

How often are you required by the people in your community of specialisation to inform others about things you know well?

The results of this question are presented in Table 5.25.

Table 5.25
Frequencies of using communities of practice for knowledge retention

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	19	12	5	0	0	3.39	0.73
Low learning companies	11	11	9	5	0	2.78	1.05

As shown in *Table 5.25*, the mean score of the high learning companies is higher (3.39) than that of the low learning group (2.78) for this learning mechanism. Moreover, their mean difference is indeed significant with an obtained $p = 0.011$. *Communities of practice* are shown to support both the knowledge sharing and the knowledge retention activities.

Project Sites

How often are you formally involved in the practice of exploiting knowledge embedded in project sites?

The results of this question are presented in *Table 5.26*.

Table 5.26
Frequencies of utilising project sites as knowledge context

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	19	13	4	0	0	3.42	0.69
Low learning companies	10	18	4	4	0	2.94	0.92

Responses to this question demonstrate that the high learning companies tend to make use of knowledge developed in the *project sites* more frequently than do the low learning companies. The mean score for the high learning company group is 3.42 and the mean score for the low learning companies is 2.94. This difference between the means is statistically significant ($p = 0.023$).

Use of Intranets

How often do you store documents or information in the intranet to make them available for other people?

The results of this question are presented in *Table 5.27*.

Table 5.27
Frequencies of using intranets for knowledge retention

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	23	1	6	6	0	3.14	1.22
Low learning companies	22	3	5	4	2	3.08	1.32

The use of intranets is equally high in both groups. Overall, managers in the construction companies ‘often’ used *intranets* to store documents or information in order to make them available for others (means = 3.14 and 3.08). There is no significant different between the means.

5.2.6 Results of Codification Mechanisms

In parallel with the results in the personalisation mechanisms, responses to the learning mechanisms in this section are very much like the responses obtained in the knowledge sharing questions for each individual learning mechanism. Again, this hints to the degree of reliability of both the results and the instrument used in this research.

Codified Information

How often do you produce written documents such as drawings, reports, sketches, and graphs in relation to your work?

The results of this question are presented in *Table 5.28*.

Table 5.28
Frequencies of producing codified information

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	17	16	3	0	0	3.39	0.64
Low learning companies	21	11	4	0	0	3.47	0.70

The use of *codified information* as one of the knowledge retention activities is equally high in both groups (means 3.39 and 3.47) and their mean difference is not significant. All managers in both groups at least ‘sometimes’ produced *codified information* as part of their work, such as in the form of drawings, reports, sketches, and graphs.

Personal Notes

How often do you take personal notes, for example, to record any important facts, decisions or actions in relation to your work?

The results of this question are presented in Table 5.29.

Table 5.29
Frequencies of producing personal notes to record facts, decisions and actions

	<i>Always</i> (4)	<i>Often</i> (3)	<i>Sometimes</i> (2)	<i>Rarely</i> (1)	<i>Never</i> (0)	<i>Mean</i>	<i>Std.</i> <i>Deviation</i>
High learning companies	11	4	4	13	4	2.19	1.43
Low learning companies	19	9	4	3	1	3.17	1.11

The responses to this learning mechanism vary greatly from ‘never’ to ‘always’. Interestingly, the people from the low learning companies tend to produce *personal notes* more frequently than do the people from the high learning group (means = 3.17 and 2.19, respectively). The mean difference between the groups is highly significant ($p = 0.004$) in this learning mechanism.

Personal Case Writings

How often do you take the opportunity to write down your personal reflections about a project or task you have experienced?

The results of this question are presented in Table 5.30.

Table 5.30
Frequencies of using personal case writings to record personal experiences

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	10	2	13	10	1	2.28	1.23
Low learning companies	20	11	5	0	0	3.42	0.73

Interestingly, the result of this question indicates that the use of *personal case writings* is more popular among managers in the low learning companies than in the high learning companies. The mean difference between the high and the low learning groups is also highly significant ($p < 0.001$).

Standardised Methods and Best Practices

How often are you involved in the practice of developing a standard method of doing something that relates to your work?

The results of this question are presented in Table 5.31.

Table 5.31
Frequencies of using standardised methods and best practices for knowledge retention

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	24	7	3	2	0	3.47	0.88
Low learning companies	27	3	6	0	0	3.58	0.77

The use of *standardised methods and best practices* is equally prevalent in both company groups. The mean scores are 3.47 and 3.58 for the high and the low learning companies, respectively, whilst the mean difference is not significant at $\alpha = 0.05$.

Company Databases

How often are you required to produce information related to your work to be stored in the company databases?

The results of this question are presented in *Table 5.32*.

Table 5.32
Frequencies of using company databases to store information

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	24	9	3	0	0	3.58	0.65
Low learning companies	23	13	0	0	0	3.64	0.49

It is noteworthy that *company databases* were rated as one of the most frequently used methods for supporting both knowledge sharing and knowledge retention activities by the construction companies. Almost all managers, except three, in the sample companies claimed that they ‘often’ or ‘always’ used the *company databases*.

Company Newsletters

How often are you required to provide material or information related to your job to be published in your company newsletters?

The results of this question are presented in *Table 5.33*.

Table 5.33
Frequencies of using company newsletters as a knowledge retention mechanism

	<i>Always (4)</i>	<i>Often (3)</i>	<i>Sometimes (2)</i>	<i>Rarely (1)</i>	<i>Never (0)</i>	<i>Mean</i>	<i>Std. Deviation</i>
High learning companies	24	4	5	3	0	3.36	1.02
Low learning companies	21	9	1	5	0	3.28	1.06

There is only a slight difference in the mean scores for both groups in the answer to this question. People from both groups make use of *company newsletters* at considerably high frequencies (means = 3.36 and 3.28). Twenty-four (67%) and 21 (58%) managers from the high and the low learning companies, respectively, claimed that they ‘always’ published information through the *company newsletter*.

5.2.7 Differences in Responses by Respondents' Position

A non-parametric test (Mann-Whitney *U*-test) was again employed to compare the scores of three key variables in the research framework for top managers, middle managers and frontline managers. The results are recorded in *Tables 5.34* and *5.35*.

Table 5.34
Differences in responses by respondents from high learning companies

Variable	Position of respondents		
	Top manager	Middle manager	Front-line manager
Knowledge acquisition mechanisms	3.48 ^a (0.46) ^b	3.37 (0.53)	3.26 (0.58)
	$p_1 = 0.574$	$p_3 = 0.234$	$p_2 = 0.505$
Knowledge sharing mechanisms	3.25 (0.45)	3.10 (0.44)	2.97 (0.50)
	$p_1 = 0.378$	$p_3 = 0.114$	$p_2 = 0.410$
Knowledge retention mechanisms	3.25 (0.49)	3.13 (0.43)	3.02 (0.49)
	$p_1 = 0.347$	$p_3 = 0.143$	$p_2 = 0.443$

Notes: The p values p_1 refers to the significance difference between top and middle manager means, p_2 to that between middle and front-line manager means, and p_3 to that between top and front-line manager means.

^a The figures in the table are mean responses from the interviews.

^b The figures in parentheses are standard deviations.

Table 5.35
Differences in responses by respondents from low learning companies

Variable	Position of respondents		
	Top manager	Middle manager	Front-line manager
Knowledge acquisition mechanisms	3.61 (0.62)	3.17 (0.82)	2.94 (0.83)
	$p_1 = 0.234$	$p_3 = 0.100^*$	$p_2 = 0.279$
Knowledge sharing mechanisms	3.54 (0.34)	3.18 (0.42)	2.90 (0.48)
	$p_1 = 0.045^{**}$	$p_3 = 0.002^{***}$	$p_2 = 0.100^*$
Knowledge retention mechanisms	3.54 (0.34)	3.17 (0.43)	2.90 (0.47)
	$p_1 = 0.039^{**}$	$p_3 = 0.002^{***}$	$p_2 = 0.198$

* $p < 0.1$; ** $p < 0.05$; *** $p \leq 0.01$

Table 5.34 shows that there are no significant differences between top, middle and front-line managers of the high learning companies in respect of their assessment of the practice of learning in their company. This remains indicatively true when the variations of means are analysed at individual company level as revealed by the charts in Figure 5.1. These charts demonstrate that there are only relatively small variations occurring in the scores provided by managers. In general, it appears that the practices that contribute to organisational learning are widely shared by managers at all levels in this group of construction companies. Arguably, this can be attributed to the presence of shared beliefs or shared mindsets among the people in these companies. Shared mindsets indicate that the organisations' members have a common understanding on aspects concerning the practice in their company (Buckley *et al.*, 2006). In fact, the presence of shared beliefs is one of the characteristics of the learning organisation (Senge, 1990). According to Love *et al.* (2004), shared belief among people of different functions in a construction organisation is essential because cross functional collaboration can only stimulate learning when mental barriers are overcome.

Figure 5.1
Charts showing the variations of means provided by managers
in the high learning companies

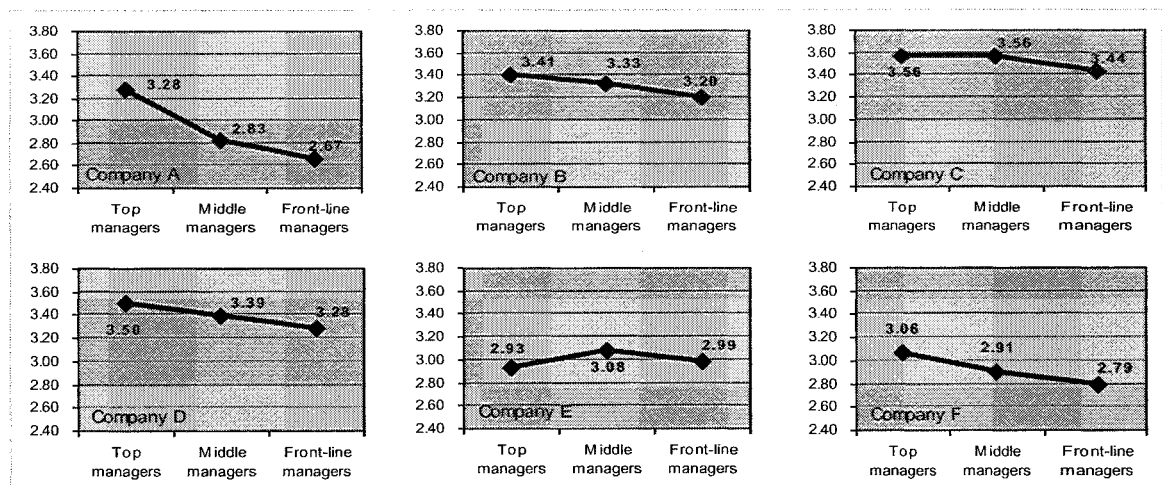
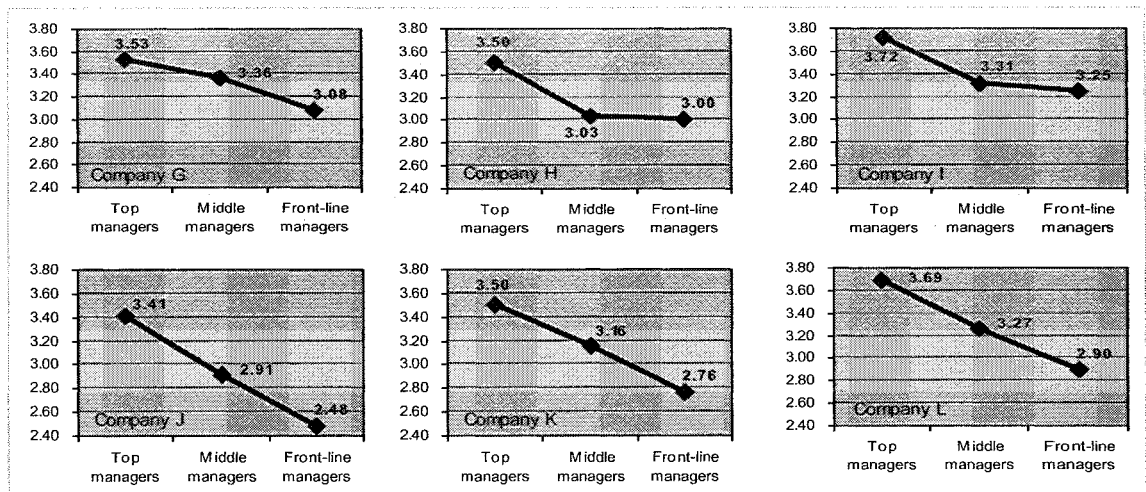


Table 5.35 summarises the results of the Mann-Whitney *U*-test for the low learning group. The outcomes are clearly different from that of the high learning group. As shown in the table, the *p* values are mostly significant for the various pairs. The mean difference between the top and the front-line managers is significant in respect to knowledge acquisition mechanisms. Significant differences are particularly evident between top, middle and front-line managers in all pairs with regard to knowledge sharing mechanisms. As for knowledge retention mechanisms, significant differences also appear between top and middle managers and between top and front-line managers, but not between middle and front-line managers. An analysis into each individual company reveals even more strong evidence of the high variation in means by different groups of management. The charts of mean in Figure 5.2 demonstrate an almost regular trend with regard to the variations of mean scores provided by managers in this group. In almost all cases, it is evident that the upper management layers provided more optimistic evaluations than did the lower layers. Thus, the mean score is highest at the top management level and lowest at the front-line management level.

Figure 5.2
Charts showing the variations of means provided by managers in the low learning companies



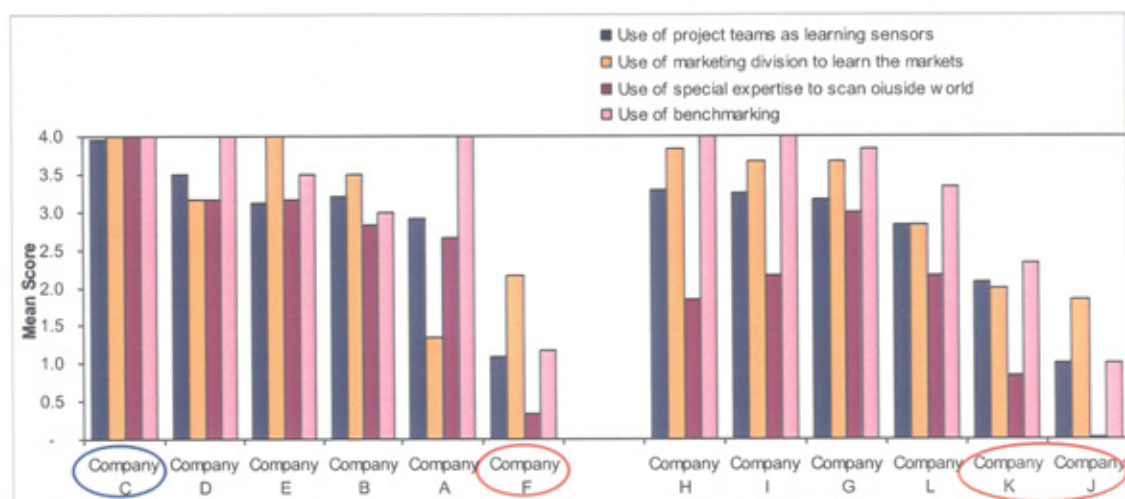
5.2.8 Cross Case Comparison on the Use of Learning Mechanisms

This section compares the use of learning mechanisms by construction companies. The mean scores of the learning mechanisms provided by managers of construction companies are drafted in a bar-chart diagram to allow cross company analyses and comparisons to be made. Some interesting findings that appeared from the analysis are highlighted.

External Knowledge Acquisition Mechanisms

Figure 5.3 presents the result of aggregated scores of the application of external knowledge acquisition mechanisms by the companies.

Figure 5.3
External knowledge acquisition mechanisms by companies



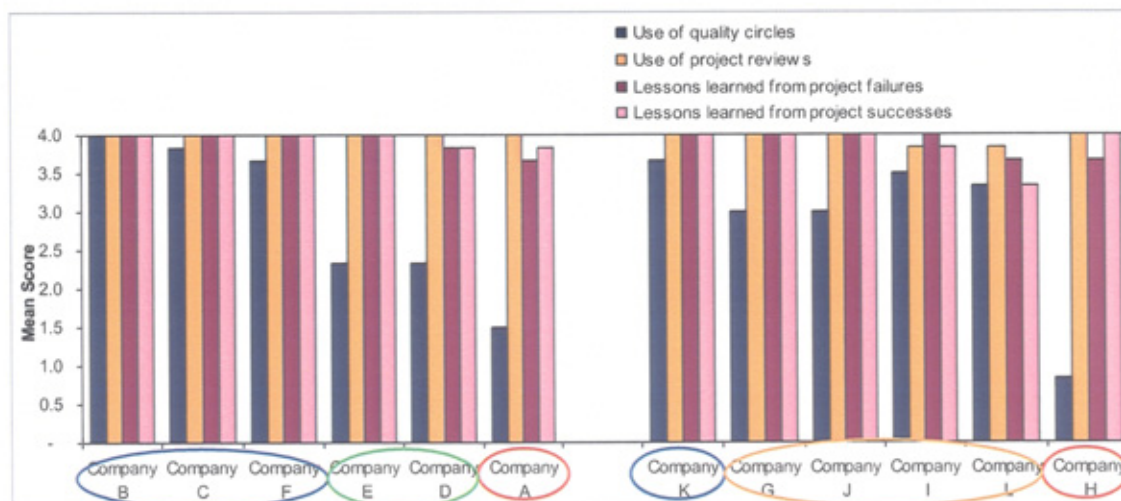
As shown in Figure 5.3, the application of external learning mechanisms varies greatly among the construction companies between and within the groups. As was expected, there is an indication that the high learning companies group employ more extensive applications of learning mechanisms than do the low learning companies group. This is particularly evident in Company C, which has the most comprehensive application of external learning mechanisms ‘to a very great extent’ (mean score > 3.5). Company C exploited the use of *marketing division to learn the markets*, *special expertise to scan the outside world*, and *benchmarking to learn from competitor performances* all ‘to a very great extent’ (score 4). However, this finding is not a conclusive one since there is

also an indication that company type and size may have influenced the results, for example as demonstrated by Companies F, J and K. All of these companies ‘to a small extent’ or ‘not at all’ employ *special expertise* to scan the external environment. Thus, it appears that smaller construction companies employ less extensive applications of external learning mechanisms. Moreover, Companies F, J and K are all engaged in specialty contracting activity.

Internal Knowledge Acquisition Mechanisms

Figure 5.4 presents the aggregated scores of the application of internal knowledge acquisition mechanisms by the companies.

Figure 5.4
Internal knowledge acquisition mechanisms by companies

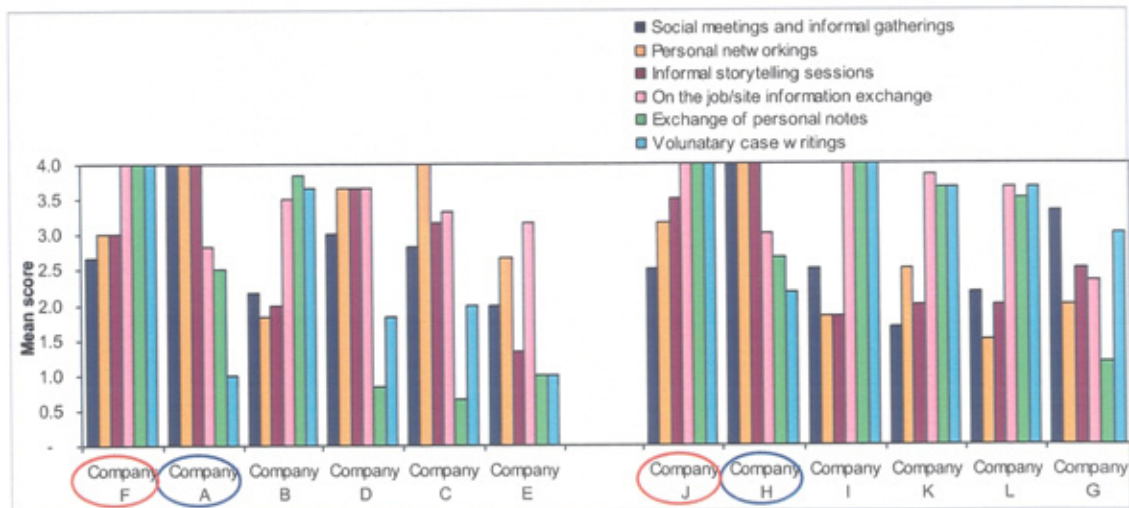


Overall, as was indicated earlier, the construction companies employ a more extensive use of internal learning mechanisms in comparison to the use of external learning mechanisms. The use of *project reviews*, *lessons learned from project failures*, and *lessons learned from project successes* are among the three most comprehensively employed internal learning mechanisms by the construction companies of all groups. The *use of quality circles* is particularly varied among the construction companies. Companies A and H are among those that made the least efforts to nurture quality circles. Companies D and E employed *quality circles* ‘to a moderate extent’, whilst Companies B, C, F, and K used this mechanism ‘to a very great extent’ and Companies G, I, J, and L ‘to a large extent’.

Informal Knowledge Sharing Mechanisms

Figure 5.5 presents the aggregated scores of the application of informal knowledge sharing mechanisms by the companies.

Figure 5.5
Informal knowledge sharing mechanisms by companies



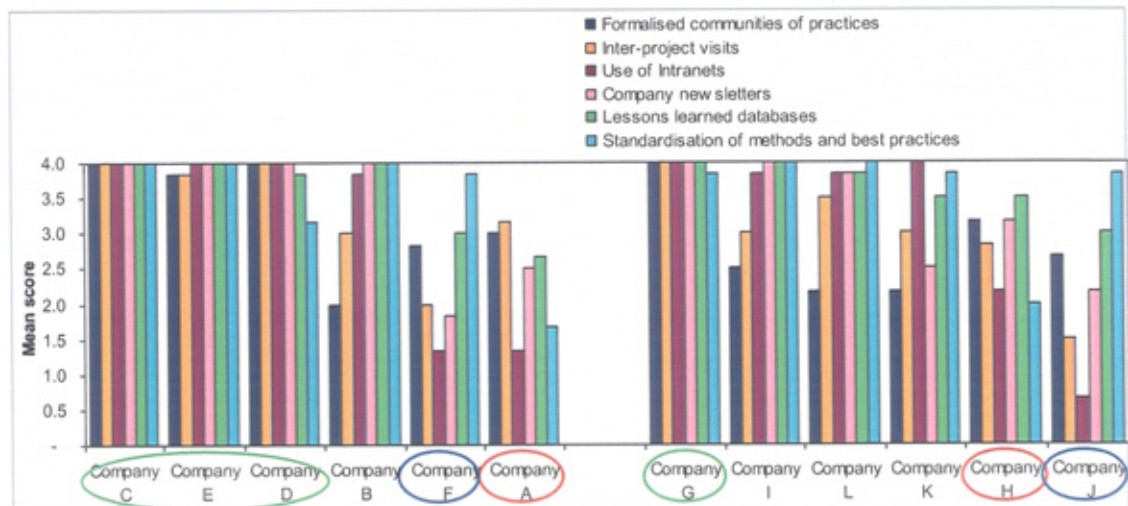
As shown in Figure 5.5, there is a high degree of variation both in the combination and in the extent of use of informal knowledge sharing mechanisms among the construction companies. The involvement in the *social meetings and informal gatherings*, use of *personal networkings* and engagement in *informal storytelling sessions* are particularly extensive among people in Companies A and H. Both are smaller companies with fewer than 250 employees and are mainly engaged in general building contracting activities.

There is a great similarity in the practices of *on the job/site information exchange*, *exchange of personal notes*, and *voluntary case writings* in Companies B, F, I, J, K and L. All of these companies are specialty companies that focus on a narrow range of activities and tend to keep their project teams together for different projects. Interestingly, except Companies F and J, which are smaller companies (< 250 employees), these companies tend to have less activity in areas that involve direct personal interaction such as *social meetings and informal gatherings*, *personal networking*, and *informal storytelling*.

Formal Knowledge Sharing Mechanisms

Figure 5.6 presents the aggregated scores of the application of formal knowledge sharing mechanisms by the companies.

Figure 5.6
Formal knowledge sharing mechanisms by companies



Comprehensive practices of formal knowledge sharing mechanisms are evident in Companies C, D, E, and G. All of these companies are large companies with over 250 employees and operate nationally or even internationally. Managers in these companies reported ‘always’ practising or promoting the use of *formalised communities of practices*, *inter-project visits*, *intranets*, *company newsletters*, *lessons learned databases*, and *standardisation of methods and best practices* as part of their work.

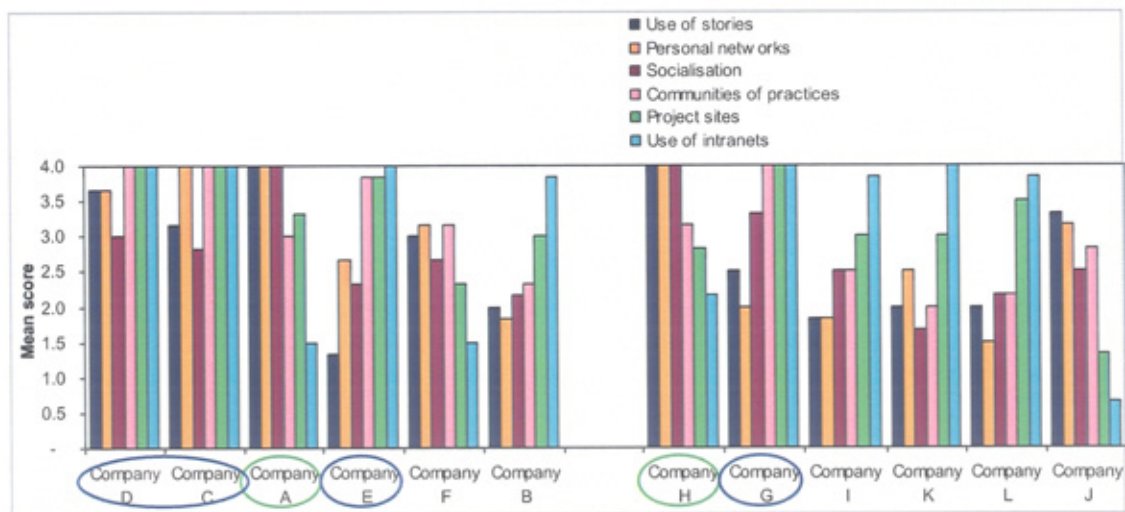
Companies A and H demonstrate less prevalent applications of formal knowledge sharing mechanisms. The characteristics of the two companies are quite similar in that they are smaller companies with fewer than 250 employees and are mainly engaged in general contracting activities as main contractors. Companies F and J exhibit fairly similar behaviours in their application of formal learning mechanisms. The use of *standardisation of methods and best practices* is the only formal knowledge sharing mechanism that was ‘always’ employed in these companies, whilst *intranets* were ‘rarely’ used to support knowledge sharing. Companies F and J are specialists in ‘security glazing’ and ‘ceiling’ works, respectively. They share similar characteristics in that both are small companies, operating in a centralised geographical area, have a

narrow range of skills and are mostly engaged in repeat businesses as a sub-contractor of larger companies.

Personalisation Mechanisms

Figure 5.7 presents the aggregated scores of the application of personalisation mechanisms for knowledge retention by the companies.

Figure 5.7
Personalisation mechanisms by companies



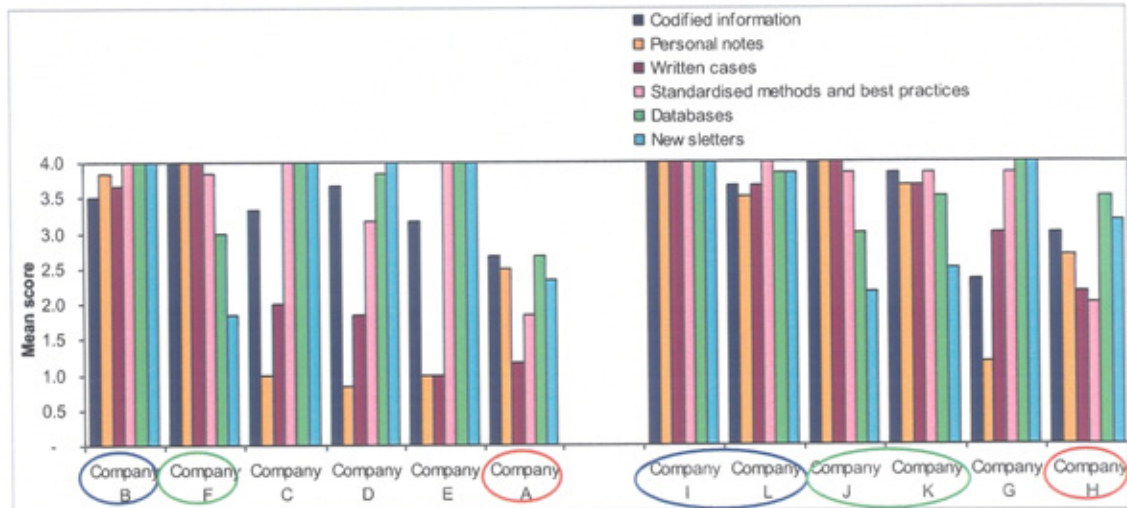
Again, Companies A and H demonstrate similar behaviours in their practice of personalisation mechanisms. The use of *stories*, *personal networks* and *socialisation* are among the three most prevalent mechanisms for retaining knowledge of the organisation in these companies.

Another group of companies that share similar behaviours regarding their application of personalisation mechanisms comprise Companies C, D, E, and G. The practice of personalisation mechanisms in these companies is characterised by the extensive exploitation of *communities of practices*, *project sites*, and *intranets* in support of organisational learning. The four companies are large general contractors operating nationally and internationally, engaged in multidiscipline activities and working with a wide range of clients.

Codification Mechanisms

Figure 5.8 presents the aggregated scores of the application of knowledge codification mechanisms by the companies.

Figure 5.8
Knowledge codification mechanisms by companies



Companies B, L, and I claim the most comprehensive use of knowledge codification mechanisms. Most managers of these companies rated themselves as ‘always’ using *codified information*, *personal notes*, *written cases*, *standard methods and best practices*, *databases*, and *newsletters* as part of the work practice in their company. All three companies are large, operating nationally and engaged in specialised activities in the area of mechanical and electrical works.

Companies F, J, and K feature similar characteristics in their practice of knowledge codification. The three companies are prominent in their use of *codified information*, *personal notes*, *written cases*, and *standard methods and practices*, but they are modest in their exploitation of *databases* and *company newsletters*. All three companies are small companies (fewer than 250 employees), engaged in a narrow range of activities, and maintain their project teams *to stay together for different projects*.

Companies A and H demonstrate the least application of knowledge codification mechanisms.

5.3 Model Development

As stated in Chapter 1, the main purpose of this thesis is to develop a model that could capture the different practices of organisational learning within the selected UK construction companies. This involves an examination of various learning mechanisms used by the participating companies with regard to their practices in addressing three learning processes: knowledge acquisition, knowledge sharing and knowledge retention. Using a 'radar' diagram, the extents of the use of various learning mechanisms are plotted to produce a graphical landscape that represents the unique profile of learning practices by each individual case company. This model can also be used as a diagnostic tool to evaluate the level of managerial effort currently being expended by a construction company towards its organisational learning activities. As shown in *Tables 5.36, 5.37, 5.38, and 5.39*, such an analysis leads to the development of organisational learning profiles that clearly illustrate to management where their learning efforts have been focused with respect to the use of various learning mechanisms within their organisations.

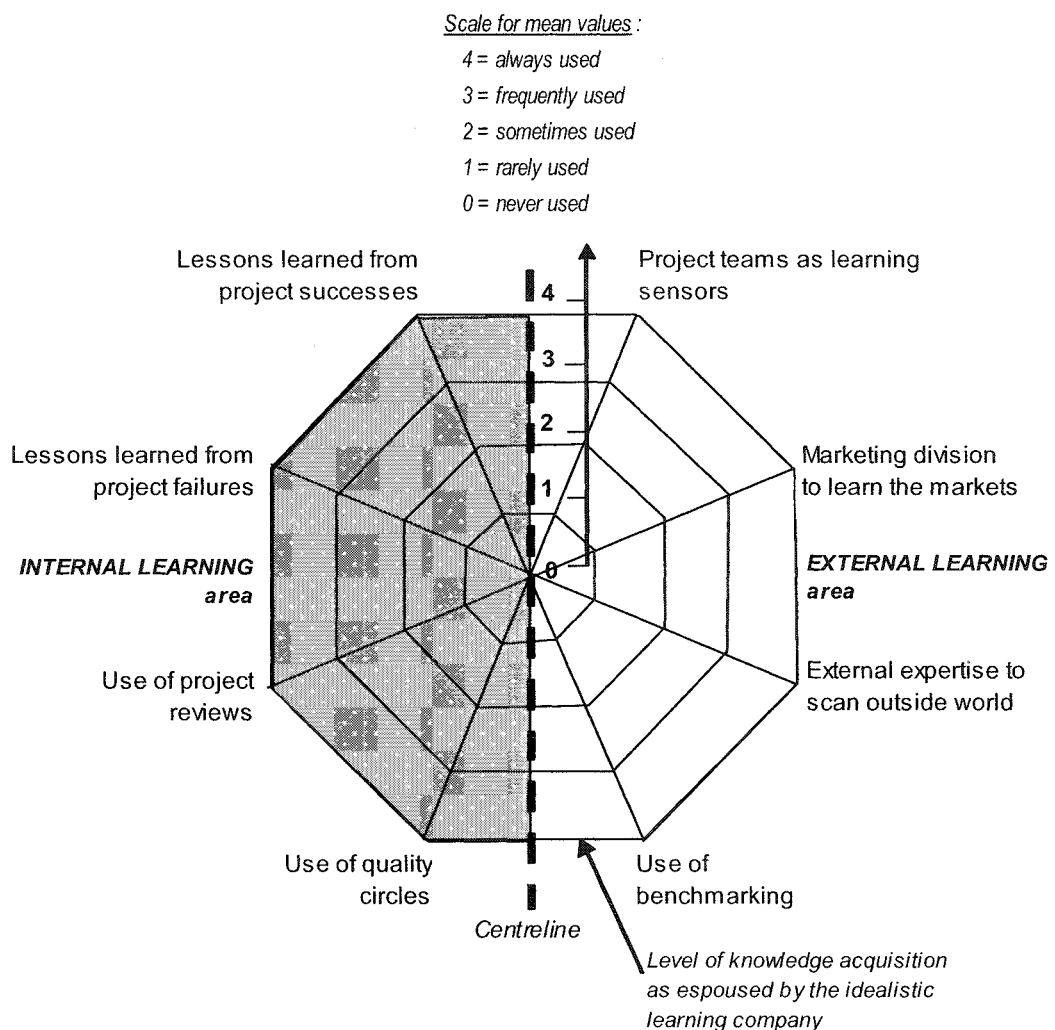
The use of radar diagrams has been a common practice in the manufacturing industries, such as for mapping customer care transformation (Thomas, 2001), for developing a situational maintenance model (Riis *et al.*, 1997), and is also frequently used as a benchmarking tool (Skandalakis and Nelder, 2001). In the construction industry, it has been used for developing an assessment model for the implementation of concurrent engineering (Khalfan *et al.*, 2001), for measuring the performance of the construction industry (CCIC, 2007), and for benchmarking project performance (Swan and Kyng, 2004).

Cross comparison between different learning profiles of construction companies provides an opportunity to discover the typicality that may be shared or the differences that may be contrasted by certain companies in the sample.

5.3.1 Modelling the Practice of Knowledge Acquisition

Figure 5.9 depicts the radar diagram for mapping the practice of knowledge acquisition in construction companies. The diagram is divided into two sections. The half on the left (the shaded area) contains four external learning mechanisms to assess the practices of external learning. The other half on the right (the unshaded area) contains four internal learning mechanisms to assess the practices of internal learning. The mean scores of internal and external learning mechanisms were plotted against the corresponding elements of the diagram to profile the overall knowledge acquisition practice of a construction company. The resulting models are summarised in Tables 5.36, 5.37, 5.38, and 5.39.

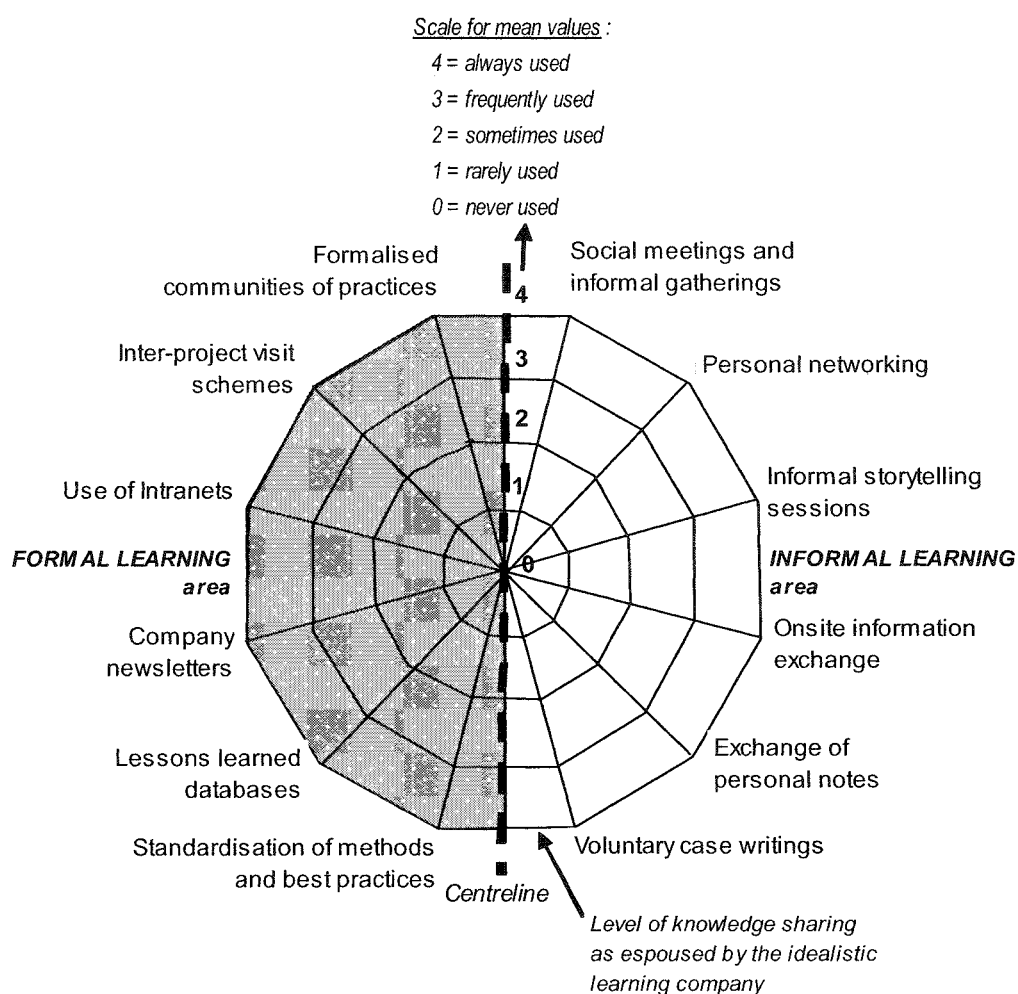
Figure 5.9
Radar diagram of knowledge acquisition



5.3.2 Modelling the Practice of Knowledge Sharing

Figure 5.10 depicts the radar diagram for mapping the practice of knowledge sharing in construction companies. The diagram is divided into two sections. The half on the left (the shaded area) contains six formal learning mechanisms to assess the formal practices of knowledge sharing. The other half on the right (the unshaded area) contains six informal learning mechanisms to assess the informal practices of knowledge sharing. The mean scores of formal and informal learning mechanisms were plotted against the respective elements of the diagram to profile the overall knowledge sharing practice of a construction company. The resulting models are summarised in Tables 5.36, 5.37, 5.38, and 5.39.

Figure 5.10
Radar diagram of knowledge sharing



5.3.3 Modelling the Practice of Knowledge Retention

Figure 5.11 depicts the radar diagram for mapping the practice of knowledge retention in construction companies. The diagram is divided into two sections. The half on the left (the shaded area) contains six personalised learning mechanisms to assess the practices of retaining learning through personalisation. The other half on the right (the unshaded area) contains six codified learning mechanisms to assess the practices of retaining learning through codification. The mean scores of personalisation and codification mechanisms were plotted against the respective elements of the diagram to profile the overall knowledge retention practice of a construction company. The resulting models are summarised in Tables 5.36, 5.37, 5.38, and 5.39.

Figure 5.11
Radar diagram of knowledge retention

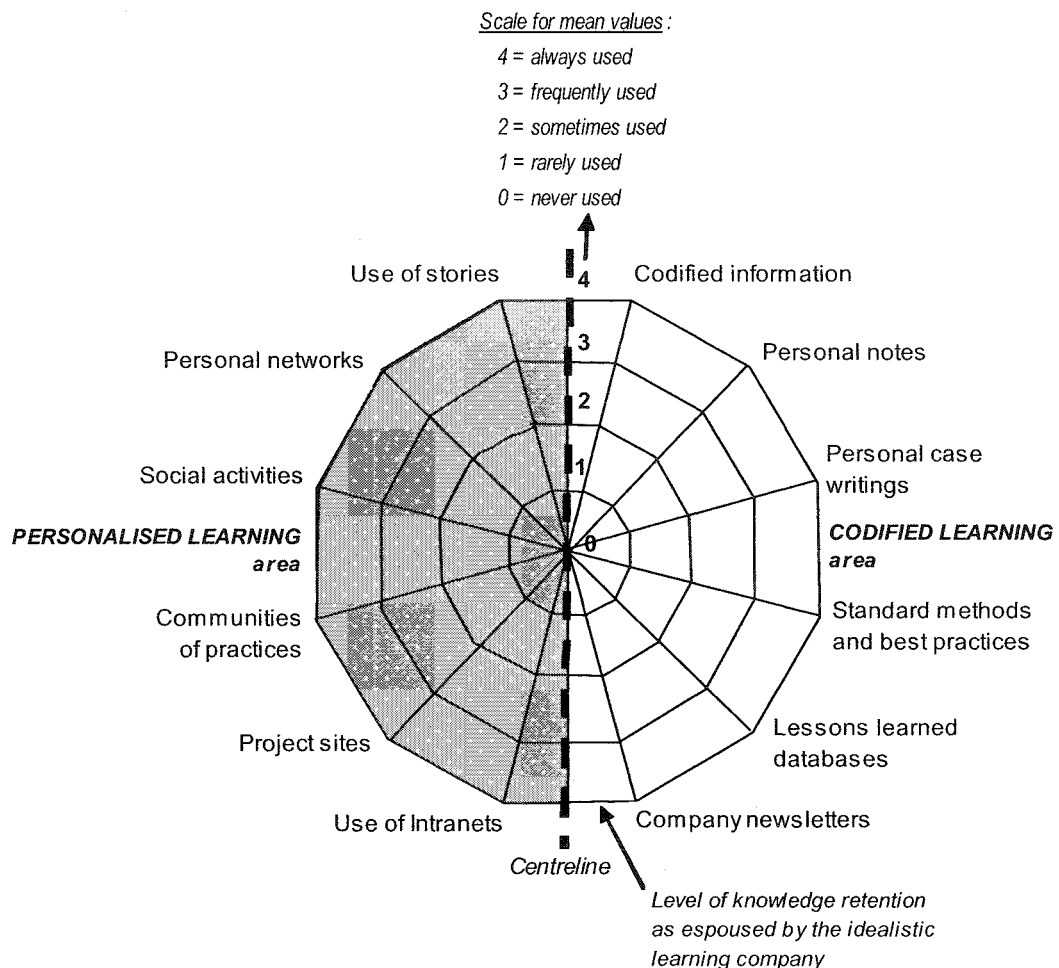


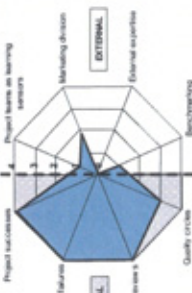
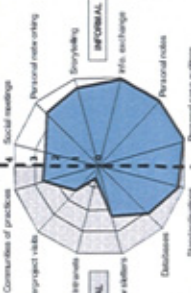
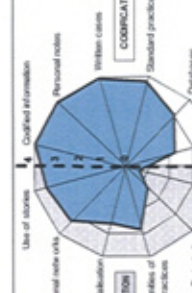
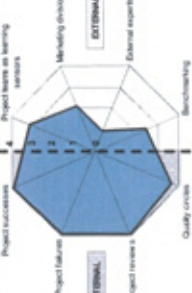
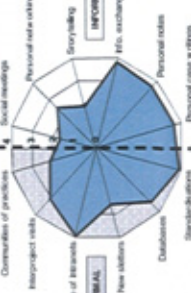
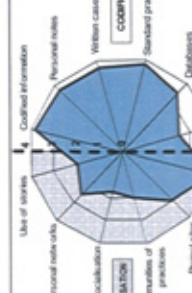
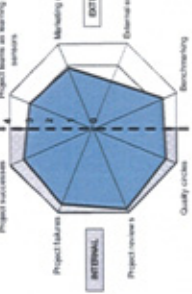
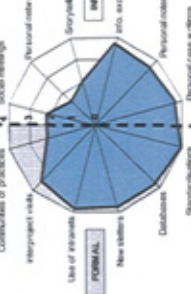
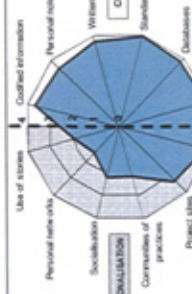
Table 5.36
Summary Sheets for Companies A, B, and C

Company A		Company B		Company C	
<p>A medium-sized, market focused, general building contractor based in the North East of England. It has been in the construction business for 100 years and has just recently completed a management buy-out strategy.</p>		<p>The mechanical and electrical (M/E) engineering division of the UK's largest building services contractor and one of Europe's leaders in the market.</p>		<p>The Northern construction division of a large general contractor working internationally with total capability in the design, procurement, and delivery of major projects. The company leads the field in health design and construction, and is at the forefront of NHS procurement initiatives.</p>	
<p>Main contracting activity : General building Company size : 200 employees Network of offices : Collocated in the NE area Profit/employee (unit) : 2,100 Learning competence test : 1st rank</p>		<p>Main contracting activity : Specialty M/E engineering Company size : 4,000 employees Network of offices : 20 offices distributed nationally Profit/employee (unit) : 3,200 Learning competence test : 1st rank</p>		<p>Main contracting activity : General contracting Company size : 22,000 employees Network of offices : 15 offices distributed internationally Profit/employee (unit) : 5,700 (most profitable general cont) Learning competence test : 1st rank</p>	
Knowledge acquisition profile		Knowledge acquisition profile		Knowledge acquisition profile	
Knowledge sharing profile		Knowledge sharing profile		Knowledge sharing profile	
Knowledge retention profile		Knowledge retention profile		Knowledge retention profile	

Table 5.38
Summary sheets for Companies G, H, and I

Company G		Company H		Company I	
<p>A major building contractor, operating throughout the UK via comprehensive network of local and regional offices. The company serves in both new buildings construction and refurbishment.</p>		<p>A young, indigenous and rapidly growing company that serves as main contractor for its sister companies within the group. The company can provide a full design and build service for both traditional and modern construction methods.</p>		<p>A large, well-established building services specialist in the UK. The winner of numerous building services awards and is the oldest running enterprise among the twelve. It has been in existence for nearly 200 years.</p>	
<p>Main contracting activity : General building Company size : 13,500 employees Network of offices : 8 offices distributed nationally Profit/employee (unit) : 4,200 Learning competence test : 10th rank (fifth lowest)</p>		<p>Main contracting activity : General building Company size : 90 employees Network of offices : Collocated in the NE area Profit/employee (unit) : 5,000 Learning competence test : 11th rank (fourth lowest)</p>		<p>Main contracting activity : Specialty M/E engineering Company size : 1,400 employees Network of offices : 12 offices distributed nationally Profit/employee (unit) : 6,600 Learning competence test : 11th rank (fourth lowest)</p>	
Knowledge acquisition profile		Knowledge acquisition profile		Knowledge acquisition profile	
Knowledge sharing profile		Knowledge sharing profile		Knowledge sharing profile	
Knowledge retention profile		Knowledge retention profile		Knowledge retention profile	

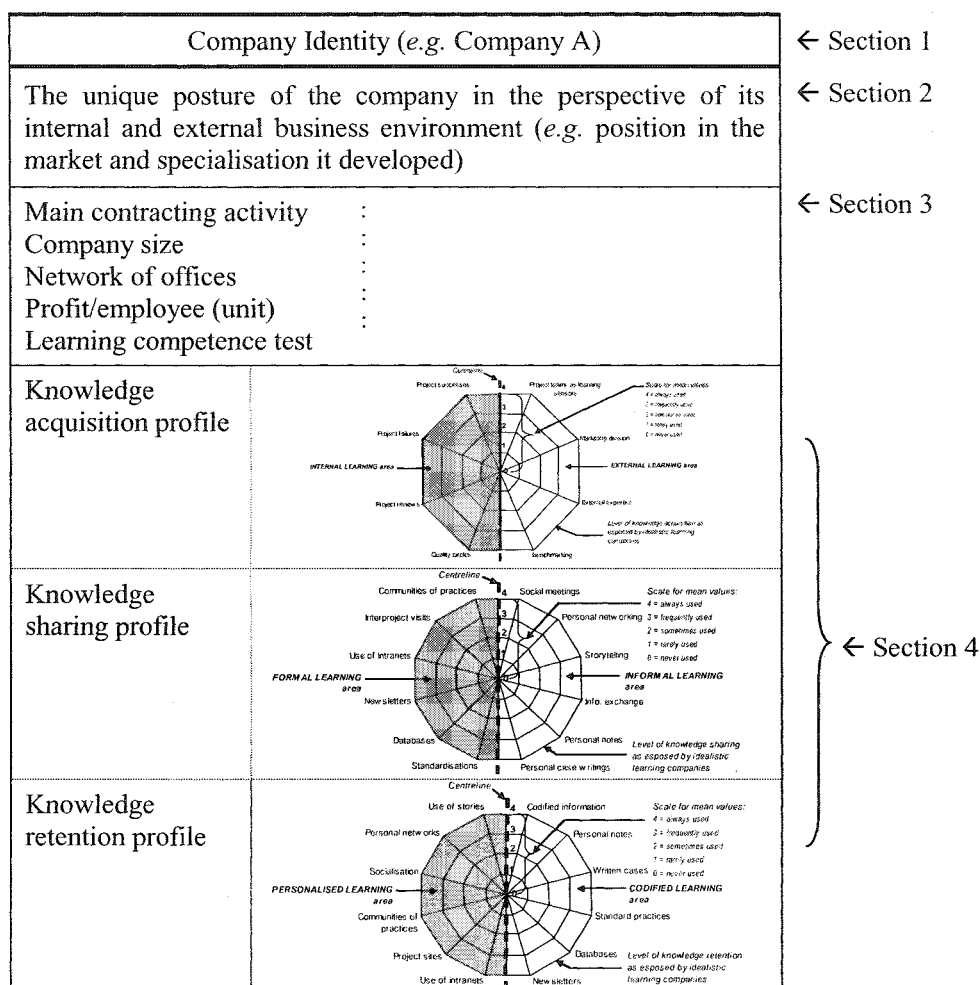
Table 5.39
Summary Sheets for Companies J, K, and L

Company J	
An indigenous, family run sub-contractor based in the North East of England. Well-known for its services in the installation of suspended ceilings and partitioning. The company maintains to work with selected established clients only.	
Main contracting activity : Specialty ceiling Company size : 100 employees Network of offices : Collocated in the NE area Profit/employee (unit) : 5,800 Learning competence test : 12 th rank (third lowest)	
Knowledge acquisition profile	
Knowledge sharing profile	
Knowledge retention profile	
Company K	
A water specialist contractor dedicated to serve public sector clients only. It operates through three offices within the Northern Britain. 95% of its turnover is attributable to repeat business.	
Main contracting activity : Specialty water engineering Company size : 250 employees Network of offices : 3 offices semi distributed Profit/employee (unit) : 5,700 Learning competence test : 13 th rank (second lowest)	
Knowledge acquisition profile	
Knowledge sharing profile	
Knowledge retention profile	
Company L	
A North East based independent company specialising in electrical and instrumentation engineering. The company serves in the national market through three regional offices targeting mainly for heavy industries and commercial projects.	
Main contracting activity : Specialty electrical engineering Company size : 400 employees Network of offices : 3 offices distributed across Britain Profit/employee (unit) : 1,300 (lowest) Learning competence test : 14 th rank (lowest)	
Knowledge acquisition profile	
Knowledge sharing profile	
Knowledge retention profile	

5.4 Learning Profiles of UK Construction Companies

Summary sheets in *Tables 5.36, 5.37, 5.38, and 5.39* provide concise resumes of selected UK construction companies involved in the model development process. Each company resume covers four key areas, subdivided into sections. Section 1 identifies the company. Section 2 features the unique posture of the company in the perspective of its internal and external business environment (e.g. position in the market and the specialisation it possesses). Section 3 features the company's relative performances in comparison with its counterparts in the sample. Section 4 profiles the learning strategy manifested in the learning profiles currently being adopted by the company. This includes the knowledge acquisition profile, the knowledge sharing profile and the knowledge retention profile. The template for company resumes is provided in *Figure 5.12*.

Figure 5.12
Template for company resumes

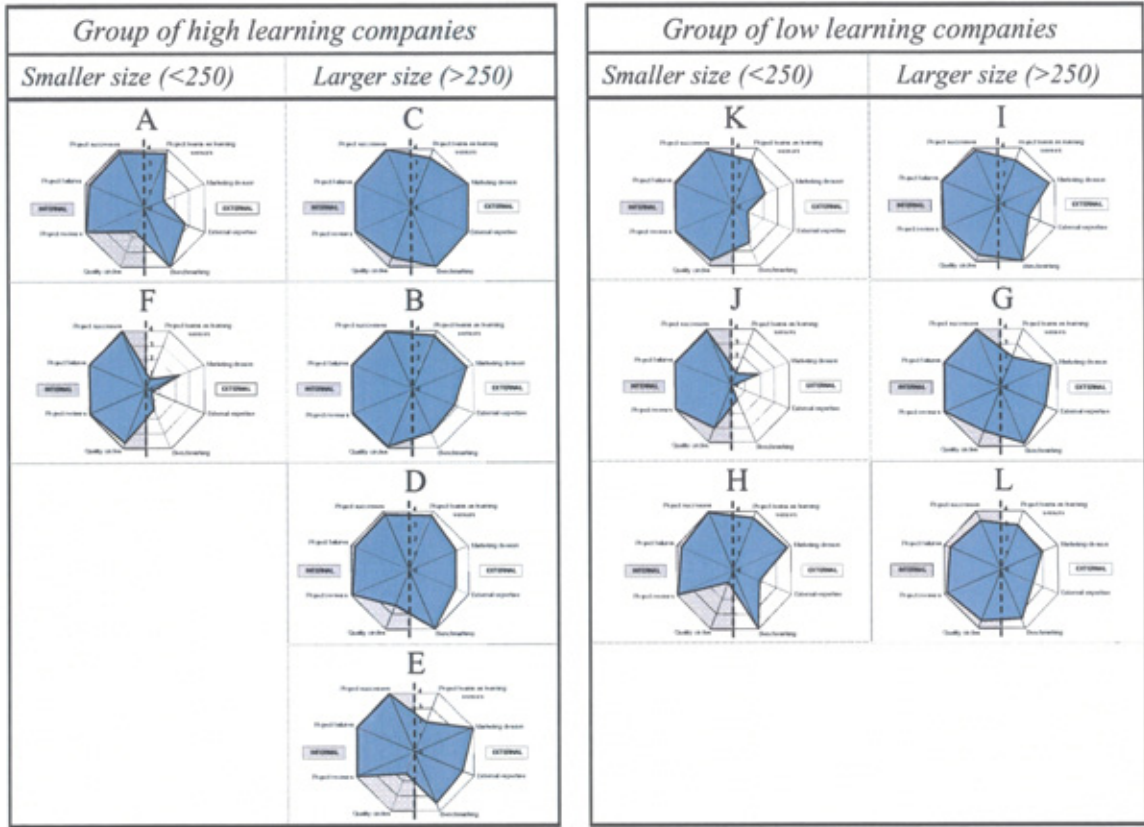


The information in the summary sheets in *Tables 5.36, 5.37, 5.38, and 5.39* clearly demonstrates that organisational learning profiles do indeed vary considerably across companies in the sample. This finding supports the basic proposition underlying the research study that was stipulated in Chapter 1. However, a cross comparison between the learning profiles indicates some noticeable patterns of similarities and differences among the companies. This issue is examined in detail in the following sections at the level of the six groupings of learning mechanisms: internal, external, formal, informal, personalisation and codification.

5.4.1 Pattern-Matching Analysis: Internal versus External Learning

In line with Yin's (1994) recommendation, the conduct of pattern-matching analysis began by organising cases into groups or categories. In this way, some patterns of similarities or differences between cases were expected to emerge. To start with, a pattern-matching analysis for internal and external learning was conducted by organising the various knowledge acquisition profiles into *Table 5.40* as follows:

Table 5.40
Pattern-matching analysis for internal and external learning



With reference to *Table 5.40*, the first important finding is that companies vary in their degrees of learning activities, which seems to be associated with their respective size and category of contracting activity. Companies C and F feature the most extreme situations that clearly reflect this finding. The latter is a medium-sized specialist company and has the narrowest range of learning activities, focusing on internal learning. The former is a very large general contractor and claims the most comprehensive use of internal and external learning mechanisms. Interestingly, both recorded considerably high profit margins and are among the most profitable companies in their respective grouping. Evidence from the rest of the group members show a positive pattern in support of this finding (see *Table 5.40*).

A cross group analysis provides even more supports for this finding. Companies J and K are both medium-sized specialty contractors from the low learning group and they exhibit the least use of external learning mechanisms, whilst strong in their internal learning mechanisms. Company G is a large general contractor and although showing relatively weak learning activities yet maintains a balanced use of internal and external learning mechanisms. Situations in Companies H, I and L are all in a positive pattern to the main finding.

Overall, evidence suggests that all companies in the sample are fairly strong in their practice of internal learning. The use of *project reviews*, *lessons learned from project failures* and *lessons learned from project successes* are the three most important learning mechanisms practiced by construction companies, irrespective of their size group and category of contracting activity. In contrast, companies vary in their practice of external learning. Companies that engage in general contracting activity are evidently stronger in their practice of external learning than companies that engage in specialty business. In the case of medium-sized general contractors, they at least employ a selective use of external learning mechanisms intensively, if not all, due to the limited resources associated with small and medium companies in general.

5.4.2 Pattern-Matching Analysis: Formal versus Informal Knowledge Sharing

Applying the same procedure as in the previous section, Table 5.41 was developed for pattern-matching analysis for formal and informal knowledge sharing.

Table 5.41
Pattern-matching analysis for formal and informal knowledge sharing

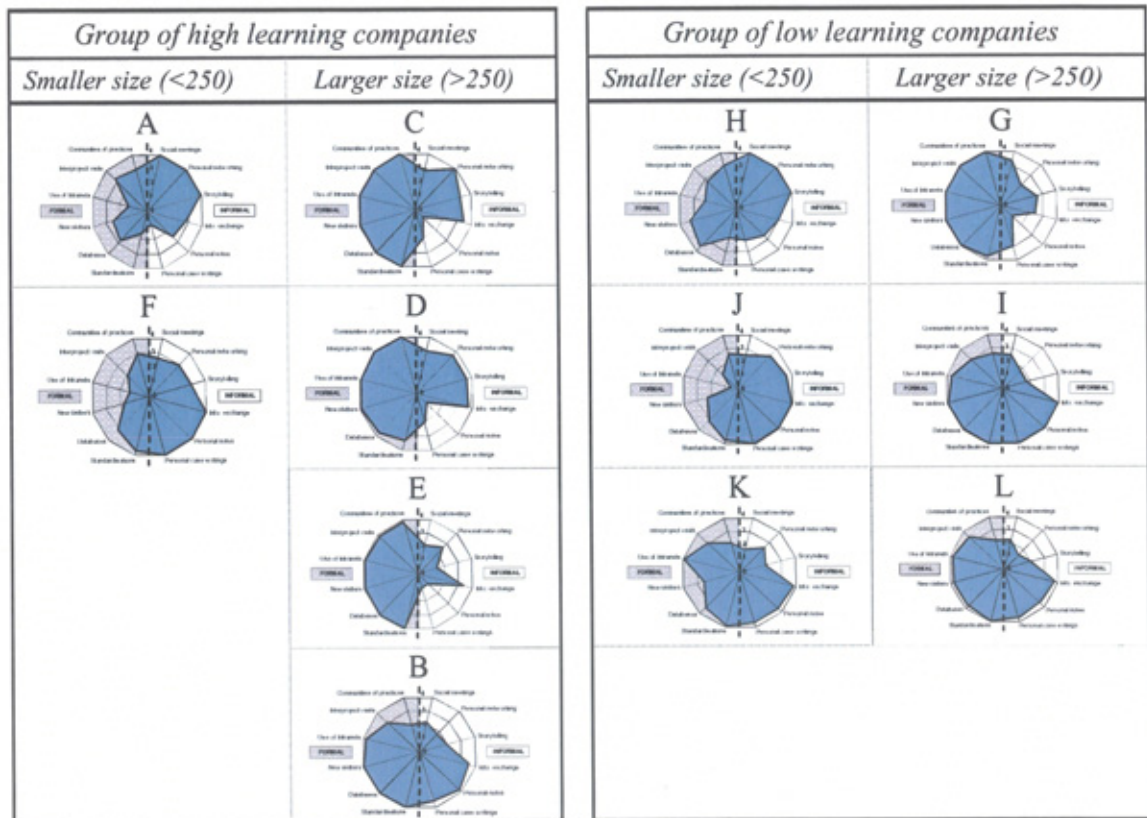


Table 5.41 shows that there is a clear variation existing in the profile of knowledge sharing espoused by construction companies. Again, the pattern of variations seems to be closely associated with company size and category of contracting activity, which are consistent with the findings in the previous section.

From the high learning group in the table, the knowledge sharing profiles of Companies A and F attract special attention. Both companies are medium-sized, operate locally within their respective area, exhibit about a similar degree of activities in the area of informal knowledge sharing, whilst being equally weak in the area of formal knowledge sharing. However, the pair disagree in their priorities in terms of the practice of engaging with knowledge sharing. Company A focuses on developing informal

knowledge sharing activities, which are mainly supportive of the process of sharing tacit knowledge. The three most highly facilitated sharing mechanisms were *social meetings and informal gathering*, *personal networking*, and *informal storytelling*. In contrast, Company F emphasises the facilitating of the exchange of informally codified knowledge such as through *onsite information exchange*, *exchange of personal notes*, and *sharing through personal case-writings*. This difference in the knowledge sharing practice may be explained by the fact that Companies A and F are indeed dissimilar in their nature of work or problems. Whilst Company A engages in a general contracting business, meaning a high degree of variation is to be expected in their projects, Company F engages in a narrowly focused specialty contracts, meaning a high degree of repeat works and standardisation are to be expected in their activities. Due to these differences in the nature of work or problems, their requirements with regard to knowledge sharing are necessarily different. Further evidence from the low learning group, such as found in Companies H and J, clearly support this finding.

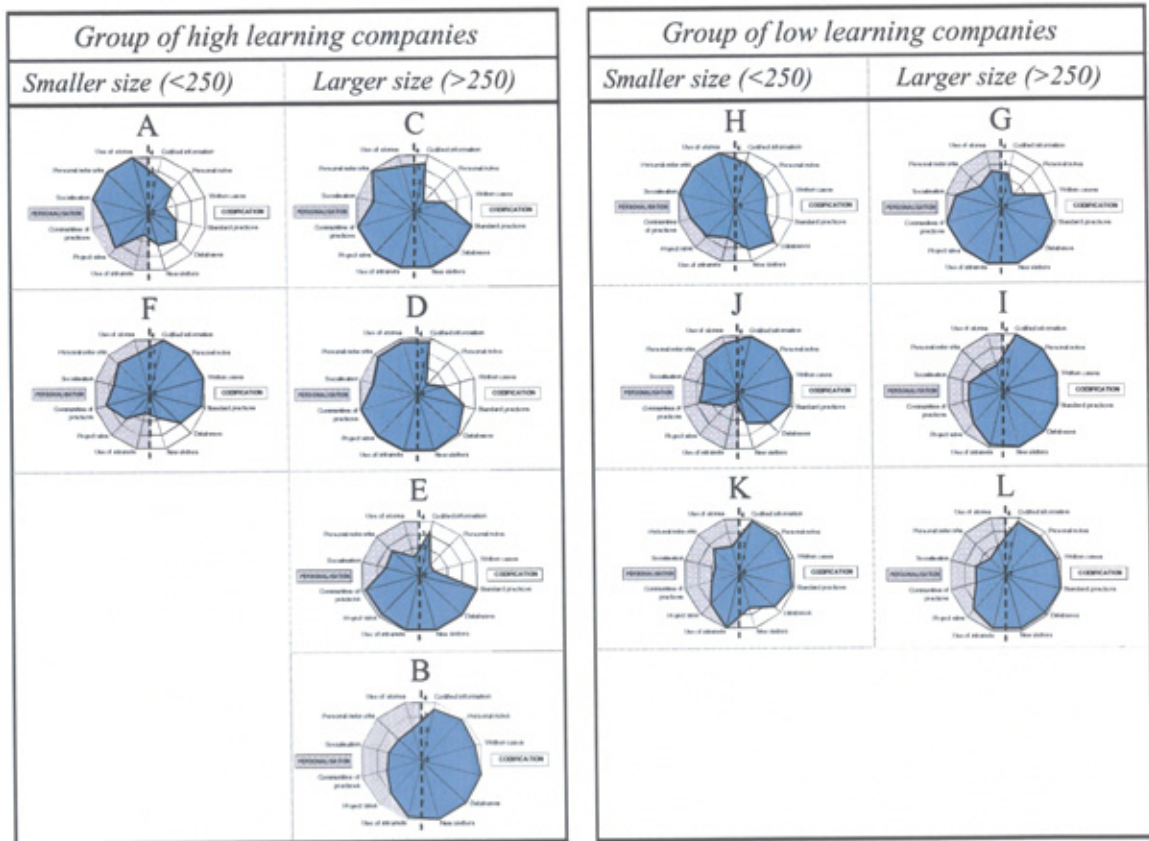
Another interesting finding occurs in the group of larger companies. Within this group, the practice of Company C is probably the role model, which seems to be closely followed by Companies D and E from the high learning group and Company G from the low learning group. Interestingly, they categorically belong to a similar grouping in that they all engage in general contracting activities and manage a distributed network of offices nationally/internationally. Another variant of knowledge sharing profile is evident in Company B, which is a large specialty company. This model seems to be followed by Companies I and L from the low learning group, with both having similar characteristics to that of Company B.

Overall, evidence suggests that smaller companies have a tendency to focus on supporting informal knowledge sharing activities. Their sharing mechanisms are mainly achieved through activities that involve a face-to-face interaction or the exchange of information between individual members of the organisation. On the other hand, larger companies tend to operate around formal mechanisms. This is particularly true when the company operates in geographically separated locations, which requires a mechanism that can extend the distribution of knowledge beyond small and collocated groups. The use of *intranets*, *newsletters*, and *databases* are among the commonly practiced mechanisms found in these companies.

5.4.3 Pattern-Matching Analysis: Personalisation versus Codification

The same procedure was employed to conduct pattern-matching analysis for personalisation and codification and the results are presented in *Table 5.42* below.

Table 5.42
Pattern-matching analysis for personalisation and codification



Synchronous patterns are found between the findings from this exercise and the findings from the knowledge sharing exercise. This should not be a surprise because the learning mechanisms being tested are actually the same in nature but are used for different purposes. For example, *intranets, databases, storytelling, personal notes, etc.* are used for both facilitating knowledge sharing and knowledge retention. This indicates the degree of reliability of the information provided by respondents in terms of meeting consistency and in terms of avoiding information resulting from random chance. This also indicates that knowledge sharing and knowledge retention are actually almost inseparable process in their true nature.

There is no clear evidence that shows the difference between the practice of companies in the high learning group and companies in the low learning group in this respect. Instead, the differences mainly occur consistently by the category of construction activity. Companies engaged in specialty contracting activity (Companies B, F, I, J, K and L) tend to make a richer use of codified mechanisms. Thus, the large parts of their organisational knowledge are retained in a codified form such as *documents, personal notes, written cases* and *standard practices*.

On the other hand, Companies engaged in general contracting activity (Companies A, C, D, E, G and H) tend to embrace personalised mechanisms in their portfolio of learning mechanisms. In contrast to specialty contractors, the general contractors' technologies are embedded in people and in the interaction between people, not in routine or standard documents.

5.4.4 Selected Best Cases: Toward a Best Practice Model

A macro analysis of the data at the pairs or groups levels provided a more general idea about the relative pattern of behaviour in terms of their learning practices and in terms of their inclination to use learning mechanisms. However, as noted previously, organisational learning practices vary significantly between the companies. Hence, a case-based analysis might help to better highlight the dynamics of the successful learning company. Two of the twelve sample companies (Companies C and F) were selected to make comparisons, as they seem very much to represent the best practice models in the overall organisational learning practices. Additionally, another two companies (Companies A and I) were introduced in the mapping for the best practice models in knowledge sharing practices.

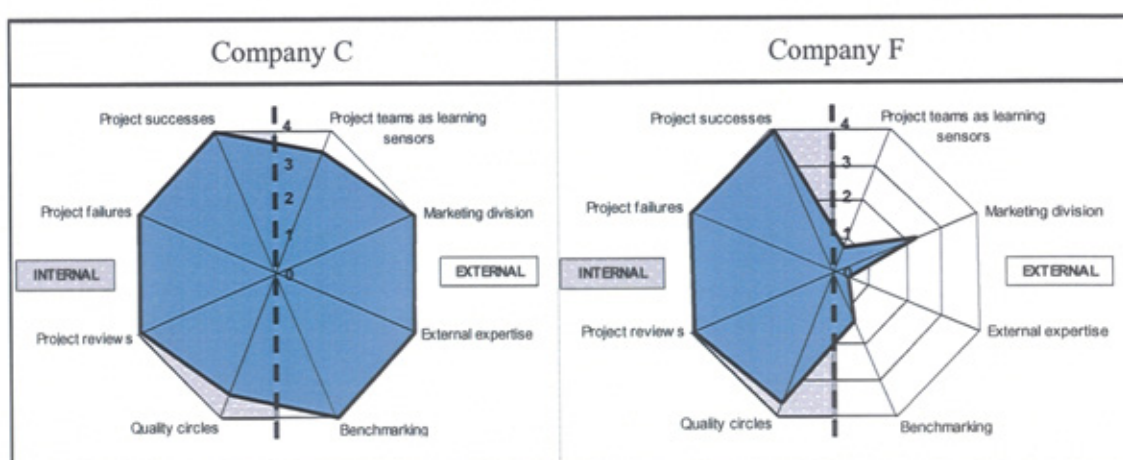
Best Practice Models for Managing Internal vs. External Learning

Company C is the Northern construction division of a large general contractor working internationally with total capability in the design, procurement, and delivery of major projects. The company leads the field in health design and construction, and is at the forefront of NHS procurement initiatives. Company C attained one of the highest scores in the learning competence test, is second largest in size, and the most profitable general contractor in the sample.

Company F is a successful and highly respected fire glazing specialist contractor, based in North East England. The company operates in a relatively narrow but well-defined market, and is a patent holder in security glazing products. 70% of its turnover is attributable to repeat business. Company F ranked 3rd in the learning competence test, and is the most profitable among the twelve companies in the sample.

The learning profiles of Companies C and F in terms of their practices in managing internal and external learning are presented in *Table 5.43* below.

Table 5.43
Best practice models for managing internal and external learning



As can be seen from their learning profiles, the differences between Companies C and F are very clear. Whilst Company C demonstrates a comprehensive use of internal and external learning mechanisms, Company F demonstrates otherwise, focusing on internal learning only. Yet, both companies are markedly successful in their respective businesses, and therefore their learning strategies.

In much of the literature that addresses an internal and external learning divide (*e.g.* March, 1991; Pedler *et al.*, 1997; Zack, 1999), an organisation such as Company C is of an ideal type. It achieves considerably a proper balance between exploiting its own internal learning and exploring the outside world through the practice of external learning. Therefore, a company like Company C is much less likely to encounter a problem such as falling into a suboptimal, stable equilibrium (Marcus and Nichols, 1999) referred to as a competency trap (Levitt and March, 1988; see Section 2.9.2). In other words, a company that fails to maintain a balance between internal and external

learning poses a danger of being locked into a competency trap or a capability learning trap (Harrison and Boyle, 2006). This is also true for the case of Company F, which shows very limited evidence of external learning activities. The only external learning mechanism claimed to be 'sometimes used' was the *use of marketing division to learn the market*.

Such a highly *internally focused learning* is not necessarily unintentional. In fact, for most companies, the espoused learning strategy reflects its competitive strategy (Hansen *et al.*, 1999). Indeed, the strategic posture of Company F as summarised in the company resume (see *Table 5.37*) appears very much to fit the description of a *defender-type organisation* (Miles and Snow, 1978). *Defender-type* organisations are characterised by a narrow and stable product-market domain. As a result of this narrow focus, these organisations seldom need to make major adjustments in their technology, structure, or methods of operation. Instead, they devote their primary attention to improving the efficiency of their existing operations, that is, through the practice of internal learning. For the case of Company F, this is mainly achieved through the intensive use of *quality circles*, *project reviews*, and the exploitation of *lessons learned from project successes* and *lessons learned from project failures*. Such a company has an advantage of being very efficient in its operation and because of its intimate familiarity with its niche market, competitors often find it difficult to dislodge this type of company from its position in the market. However, a major shift in the market could threaten its survival.

In summary, there are two strategic choices for construction companies in the pursuit of effectiveness. One is to achieve a likeness to Company C, which is necessarily ideal for larger organisations. Company C is typical of an *EXTERNALLY-FOCUSED LEARNING ORGANISATION* that maintains an extensive and balanced use of internal and external learning mechanisms. Smaller companies attempting to model the practice of Company C run the risk of inefficiency and overextension of their resources (Miles and Snow, 1978), therefore low profitability. Alternatively, construction companies may choose to model the practice of Company F by positioning themselves in a narrowly defined market or developing a selective range of specialisation and devote their primary attention to improving the efficiency of operations. Company F is typical of an *INTERNALLY-FOCUSED LEARNING ORGANISATION*. However, any company should be cautious about the danger of a competency trap and superstitious learning due to imbalanced stocks of organisational knowledge from internal and external learning

(March, 1991). Bood and Postma (1997) note that organisations that refine internal exploitation more rapidly than external exploration will turn out to be pretty efficient in the short run but ineffective in the long run. An excellent case example was reported by Pascale (1984), who described how the U.S. motorcycle manufacturers were dislodged by Japanese Honda's domination in the market due to their failure to maintain alignment with the changing external environment.

Table 5.44 provides a summary of characteristics of internally- and externally focused learning organisations as discussed above.

Table 5.44
Characteristics of internally- and externally-focused learning organisations

	<i>Externally-focused learning organisation</i>	<i>Internally-focused learning organisation</i>
Examples of best practice model	<p style="text-align: center;"><u>Company C</u></p> <p>A large general contractor working internationally with total capability in the design, procurement, and delivery of major projects. The company leads the field in health design and construction, and is at the forefront of NHS procurement initiatives. The company ranked 1st in the learning competence test, is second largest in size and the most profitable general contractor in the sample.</p>	<p style="text-align: center;"><u>Company F</u></p> <p>A successful and highly respected fire glazing specialist contractor, based in the North East of England. The company operates in a relatively narrow but well-defined market, and is a patent holder in security glazing products. 70% of its turnover is attributable to repeat business. The company ranked 3rd in the learning competence test, and is the most profitable among the twelve companies in the sample.</p>
Characteristics of learning	<ul style="list-style-type: none"> • Characterised by a balanced use of internal and external learning. • Extensive use of various learning mechanisms. • Learning is measured in terms of achieving organisational <i>effectiveness</i>: <i>"What we do, we keep our eyes on them (competitors)... and we benchmark our performance against them"</i> (Respondent C1) 	<ul style="list-style-type: none"> • Characterised by a high focus on internal learning. • Intensive use of internal learning mechanisms. • Learning is measured in terms of achieving technological <i>efficiency</i>: <i>"Our business proposition is to be technically more competent than anyone else"</i> (Respondent F1)
Advantages	Technologically flexible, which allows a rapid response to a market change.	Technologically efficient and high profitability.
Disadvantages	Risk of low profitability. The company cannot develop maximum efficiency in its operation system due to multiple technologies.	Prone to major market shift, which could threaten its survival.

As was mentioned previously, there is cost and benefit associated with each strategy. If one looks at *Table 5.43*, by comparing the profile of Companies C and F, it might seem at first sight that the best strategy for any company is to aim to model Company C. However, in terms of cost-benefit, this may not necessarily represent the most efficient strategy for a cost-focused organisation such as a Company F. There are potentially substantial costs attached to attaining a position with a high score on both learning focuses. External learning activities are especially costly as they involve a great deal of staff time, purchase of sometimes expensive market data, and probably commissioning of external research or hiring external expertises (Truch, 2004). Therefore, achieving strategic fit between the organisational learning systems and the overall business strategy is likely to involve cost-benefit analysis, which may not necessarily select the most comprehensive practices of learning – such as of Company C – as the most appropriate model.

Best Practice Models for Managing Knowledge Sharing and Retention

In presenting the best practice models for managing knowledge sharing and retention, another two companies (Companies A and I) are introduced in addition to Companies C and F. All of these companies developed a unique practice with regard to their knowledge sharing/retention mechanisms and were considered ideal for their respective needs.

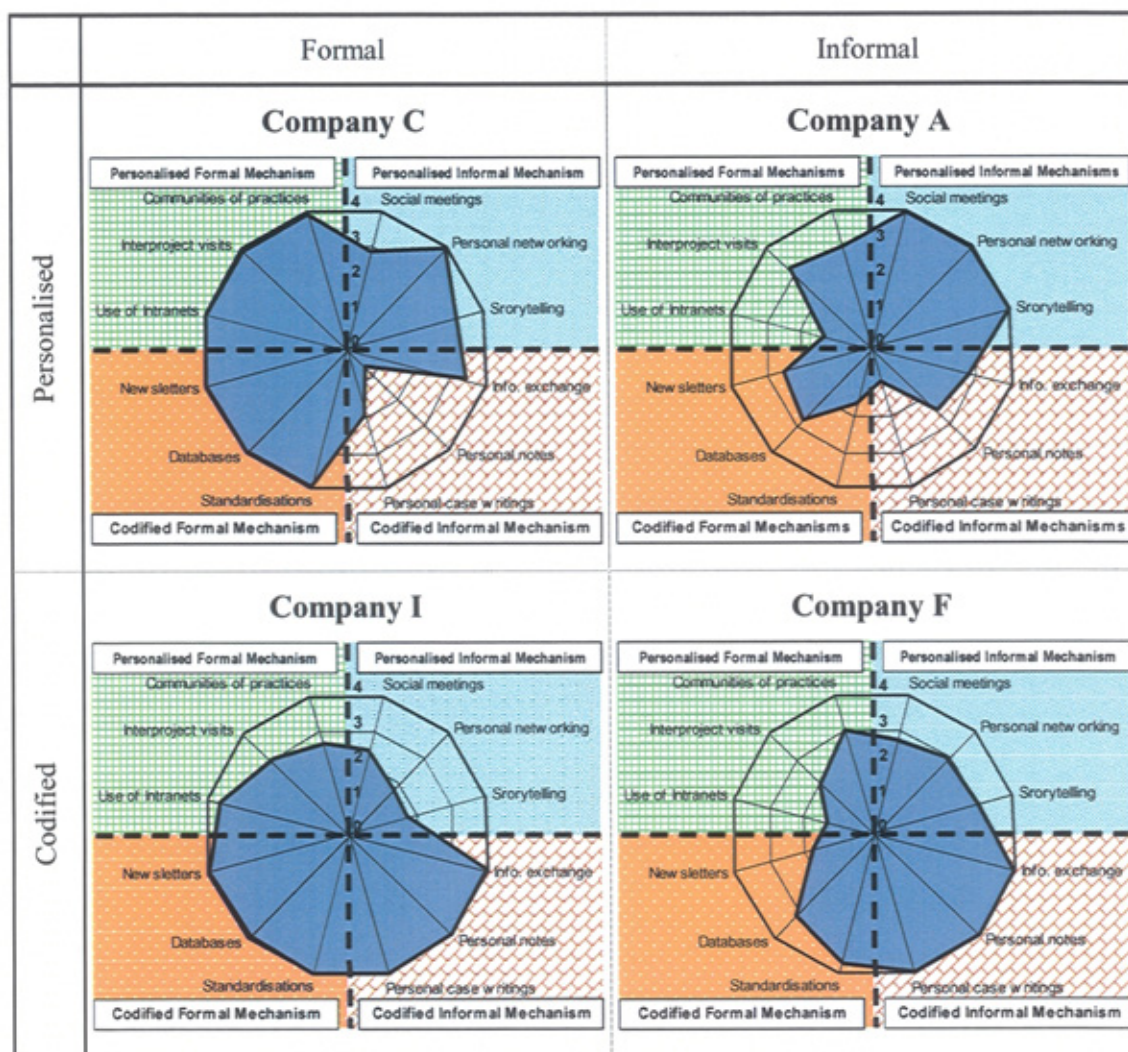
Company A is a medium-sized, market focused, general building contractor based in North East England. It has been in the construction business for 100 years and has just recently completed a management buy-out strategy. Company A ranked 1st in the learning competence test together with Company C.

Company I is a large, well-established building services specialist in the UK. The winner of numerous building services awards, it is the oldest running enterprise among the twelve. It has been in existence for nearly 200 years.

The composite version of knowledge sharing/retention models of Companies A, F, I and C are presented in *Table 5.45* below. The table uses a two-by-two matrix to allow a combined presentation of formal/informal knowledge sharing and personalised/codified knowledge retention. The practice for managing knowledge sharing and retention can be

classified using such a matrix based on the portfolio of mechanisms adopted by construction companies of different sizes and types. The columns are for formal and informal mechanisms and the rows are for personalised and codified mechanisms. Such an approach of mapping organisational learning practice using a two-by-two matrix was adopted by Nonaka and Takeuchi (1995) for developing a knowledge creation model based on the interaction between tacit and explicit knowledge.

Table 5.45
Best practice models for managing knowledge sharing and retention



As shown in *Table 5.45*, there are essentially four distinctive practices of successful knowledge sharing/retention by construction companies in the sample. These differences in practice are found to be consistently related to the company size and geographical dispersion and the category of contracting activity. For example, Company A, which is a medium-sized company, operating locally and engages in general contracting activity, has shown a successful use of *personalised informal mechanisms* to support the distribution of knowledge within the company. There is no distinction in such relationship between higher and lower learning competence groups.

Company F, which is also a medium-sized and operating locally but engages in a specialty contracting activity, has shown a successful use of *codified informal mechanisms* to facilitate the distribution of knowledge within the company. However, as a construction company grows in size and its operational centres become distributed across different regions, the company needs to facilitate knowledge sharing beyond small, collocated groups. For example, Company I which is a large company, operating through various operational centres distributed nationally and engages in a specialty contracting activity, has shown successful adoption of *formal codified mechanisms* in support to its existing *codified informal mechanisms*.

Finally, Company C, a large-sized company operating through a diverse network of offices throughout the globe and engages in general contracting business, has shown a unique adoption of *personalised formal mechanisms*, in addition to the established *codified formal mechanisms* and *personalised informal mechanisms*.

In summary, this research found that there are generally four portfolios of mechanisms for facilitating knowledge sharing and retention in construction organisations. The choice of a suitable portfolio by a construction company is dependent on the characteristics of each company, namely company size and geographical dispersion and the category of constructing activity. The four portfolios are:

- (1) *Personalised informal mechanisms* – suitable for small/medium-sized and collocated companies that engage in general contracting business. Case examples: Companies A and H.

- (2) *Codified informal mechanisms* – suitable for small/medium-sized and collocated companies that engage in a specialty contracting business. Case examples: Companies F and J.
- (3) *Codified formal mechanisms* – suitable for large and geographically dispersed companies that engage in a specialty contracting business. Case examples: Companies B, I and L.
- (4) *Personalised formal mechanisms* – suitable for large and geographically dispersed companies that engage in general contracting business. Case examples: Companies C, D, E and G.

5.5 Model Evaluation

The evaluation of the model (the three radar diagrams and the learning profiles resulting from the diagrams) was accomplished in two ways: methodological and empirical evaluations. Methodological evaluation was achieved by involving two contrasting groups of higher and lower learning performer companies in the model development process. There was no indicative evidence that points to significant differences between the findings from the high and the low learning groups in terms of providing an empirical basis to the model. In itself, this confirms the validity and generalisability of the model, which could be used to map the practice of organisational learning of construction companies across different levels of learning competency.

Empirical evaluation involved sending the model (the radar diagrams and the learning profiles) to the 12 directors/managers of the construction companies that were previously involved in the model development stage. Respondents were presented with the model and their respective organisational learning profiles that emerged from the model (see Summary Sheets) and were asked to answer the following questions:

- (1) Do the models [the organisational learning profiles] presented accurately reflect the current state of practice of organisational learning in your company? Yes/No
- (2) Are they the results of intentional strategic planning of your company? Yes/No
- (3) Do they reflect the ideal strategic learning for your organisation? Yes/No
- (4) Are they useful for the purpose of mapping organisational learning practices of your organisation? Yes/No

Eleven companies responded to the questions, leaving only a single non-responding company, *i.e.* Company E. A follow-up telephone call to one of the former subject respondents from Company E confirmed surprisingly that the company was no longer in operation under the former Company E name. The company had been acquired by its larger competitor and its head office and a number of branches were closed down following the acquisition in 2006 (a few months after the original study was completed). There was no further information to explain the reasons for the bankruptcy. However, the company had suffered heavy losses incurred in one of its overseas businesses a year prior to the acquisition.

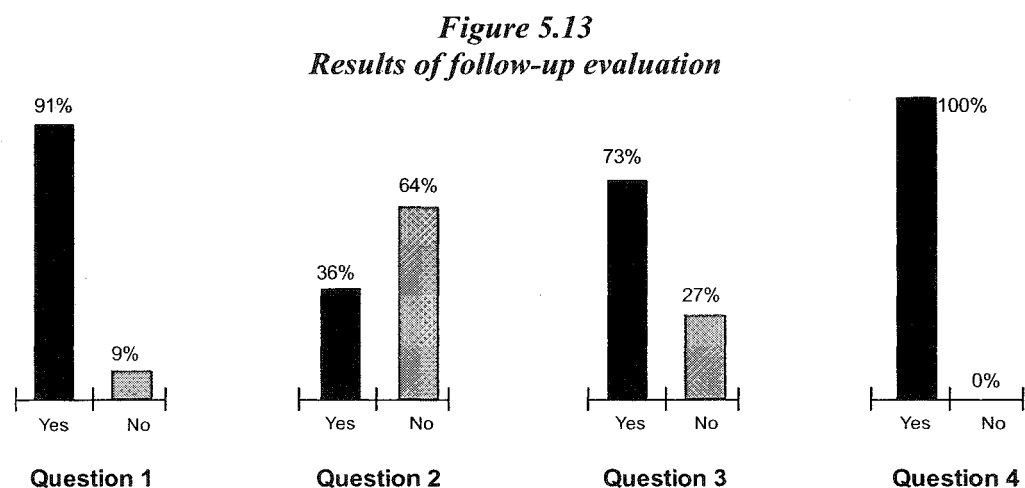
A response from Company F was received with comments noting that the company had recently ceased using its former corporate name (since April 2007). Instead, a brand new corporation had been introduced following a radical change, including a change in ownership and re-evaluation of its market domain in the previous six months. A further follow-up was conducted to investigate the reasons for the transformation and it was found that the company had just experienced great losses as a result of market decline. The former director of Company F explained that his new company would seek new growth in the aluminium framed sector, leaving behind the declining fire-glazing market.

In comparison with other companies of similar type in the sample, Company E has the weakest external learning practice. The difference is particularly palpable when compared with the best practice model of Company C. It emerges indicatively that the recent failure of Company E's overseas business was probably linked with the failure to maintain alignment with its external environment. The same is true for Company F, which exhibited the least practice of external learning mechanisms in the sample. It thus appears that the models used for mapping organisational learning practice proposed in this study would have been tremendously effective in predicting which companies were likely to have their survival threatened in the coming years.

In the section that follows, the results of empirical evaluation are presented based on the responses of directors/managers of responding companies.

5.5.1 Results of Empirical Evaluation

The results of a follow-up evaluation to the models are presented in *Figure 5.13*.



Question 1 asked respondents whether the organisational learning profiles presented accurately depict the current state of practice of organisational learning in their company. Ten respondents out of eleven confirmed that the models did accurately portray the state of current practice in their respective company.

Question 2 asked respondents whether the espoused profiles were the results of an intentional strategic planning. Only 36% respondents confirmed that their companies' espoused learning profiles were the results of conscious strategic efforts. The majority of respondents (64%) claimed otherwise, signifying that they had no conscious effort to actually develop organisational learning practices as depicted in the models.

Question 3 asked respondents whether the profiles presented reflect the ideal strategic learning for their organisation. 73% respondents confirmed that the models presented did reflect the ideal strategic learning for their organisation.

Question 4 asked respondents whether the models were useful for the purpose of mapping organisational learning practice in their organisation. All respondents agreed that the models developed in this research were useful for the purpose of mapping organisational learning practice in their organisation.

Table 5.46 presents the summary of responses by each individual company and its corresponding profiles. It can be seen from the table that there is verifiable evidence where companies with highly internal-focused learning profiles are set out to be profitable only for a certain period of time (see Companies F and J, *Table 5.46*). When the market domains in which these companies serve their business are no longer profitable, the company needs to (re)adjust themselves in line with the market changes. In case of Company J, it seems that the company is quite well prepared with this situation as demonstrated by its explicit anticipation to seek another business venture in a relatively different market domain – from the installation of suspended ceilings to fire protections works. Company F is rather unfortunate where its reaction to market change was not well anticipated early in time. The company is currently undergoing a radical change and seeking a new growth in another sector, but only after its profitability has been damaged by great losses as a result of market decline recently.

Table 5.46
Summary of responses from the follow-up model evaluation

Company	Company profile	Knowledge acquisition model	Knowledge sharing and retention model	Question 1: Do these models represent your company's practices?	Question 2: Are their profiles intended to be so?	Question 3: Do they reflect your company's ideal?	Question 4: Are they useful models?	Notes/Comments
Higher learning companies	A A medium-sized, market focused, indigenous general building contractor.			Yes	Yes	Yes	Yes	Completed a management buy-out strategy just prior to this research.
	B The UK's largest building services specialist contractor and one of Europe's leaders in the market.			Yes	No	Yes	Yes	-
	C A very large general contractor working internationally with total capability in the design and construction of major projects.			Yes	Yes	Yes	Yes	-
	D One of the leading national-based general building contractors with new management team and new culture.			Yes	No	Yes	Yes	-
	E A very large, multidiscipline engineering contractor. The largest in the sample.			-	-	-	-	The company is now being acquired by its former competitor.
	F A small glazing specialist contractor. The most profitable among the twelve.			Yes	No	No	Yes	Currently undergoing a radical change and seeking new growth in the aluminium framed sector.

Table 5.46 (Continued)
Summary of responses from the follow-up model evaluation

Company	Company profile	Knowledge acquisition model	Knowledge sharing and retention model	Question 1: Do these models represent your company's practices?	Question 2: Are their profiles intended to be so?	Question 3: Do they reflect your company's ideal?	Question 4: Are they useful models?	Notes/Comments
Lower learning companies	G A very large general building contractor operating through out the UK via comprehensive network of local and regional offices.			Yes	No	No	Yes	-
	H A young and rapidly growing company that serves as main contractor for its sister companies within the group.			Yes	Yes	Yes	Yes	-
	I A two centuries old, large contractor that maintains its core specialisation in air conditioning and heating systems.			Yes	No	Yes	Yes	Its longevity is described as a result of consistent drive to adapt to and lead change.
	J A small family run sub-contractor specialising in the installation of suspended ceilings.			Yes	Yes	Yes	Yes	The company is anticipating a new business in fire protection works.
	K A water specialist contractor. 95% of its turnover is attributable to repeat business.			Yes	No	Yes	Yes	Completed a management buy-out strategy 10 years ago.
	L An 87 years old, large instrumentation specialist contractor that works mainly for serving heavy industries.			No	No	No	Yes	-

Despite the similarity between Companies F and J in terms of their learning profiles (see their knowledge acquisition and knowledge retention/sharing models, *Table 5.46*), the follow-up model evaluation revealed different responses. In Company J, its top manager confirmed that the espoused learning profiles as depicted in *Table 5.46* are necessarily the result of an intentional strategic planning and that they do reflect the ideal strategic learning for their organisation. In contrast, Company F claimed that its learning profiles were not intended to be so and that they do not represent the ideal strategic learning posture of the company. This finding in its own confirms the notion that organisational learning may not necessarily be intentional in practice. A company may be successful in its corresponding market without actually developing organisational learning systems explicitly, but rather simply through the process of “unconscious adaptation” (James, 1999).

5.6 Chapter Conclusions

This chapter reported the results of a full data collection from which the empirical core of the thesis was based. A number of methodological approaches and analytical tools were used in the process of data analysis and presentation, including quantitative and interpretative methods.

Using a simple radar diagram as a modelling tool, the extents of the use of various learning mechanisms were modelled to expose the unique profiles of organisational learning practice in construction companies. The radar diagram models were methodologically and empirically tested and were confirmed to be useful for the purpose of mapping organisational learning practice as claimed by directors/managers of construction companies. Evidence also suggested that the models were quite effective in predicting the survivability of a construction company in the long run based on its espoused learning profiles.

6. Discussion, Conclusions and Contribution to Knowledge

"[Scientific Research] is like a voyage of discovery into unknown lands, seeking not for new territory but for new knowledge. It should appeal to those with a good sense of adventure"

- Frederick Sanger (1918)

This research journey may be considered as a voyage of discovery, producing new knowledge and evoking new learning. However, as Marcel Proust, the French intellectual and critic of the 20th century once said: "the real voyage of discovery lies not in seeking new places but in seeing with new eyes". Thus, simply finding out what one does not already know is far from being true research, as "all research needs to be informed by existing knowledge in a subject area" (Rowley and Slack, 2004: 31). Indeed, scientific research is a form of systematic enquiry, a search for relationships, comparisons, predictions and generalisations (Wing *et al.*, 1998: 103).

The route taken has so far reflected the above. It aims to establish the *relationship* between organisational learning and effectiveness, makes a *comparison* between the practices of learning by the high and the low learning companies, and develops a model that could be used to *predict* the effectiveness of organisational learning strategies of construction companies. In this final chapter, further discussion on the main findings is pursued in the context of existing theories. This includes some reflections on the possible implications to the *wider perspective* of UK construction companies.

6.1 Discussion of Main Findings and Hypotheses Testing

The statistical analysis of the empirical results presented in Chapters 4 and 5 identified a number of significant patterns in the data. This was confirmed by a 'pattern-matching' analysis (Yin, 1994) conducted in Chapter 5. In this section, these findings are further explored and discussed in the context of existing theories established in Chapter 2 and to test the hypotheses developed in Chapter 3. The structure of presentation follows the order of hypotheses summarised in *Table 3.1*.

6.1.1 Knowledge Acquisition

Knowledge acquisition in an organisation is attainable through internal and external learning (Dixon, 1992; DiBella *et al.*, 1996; Jordan and Jones, 1997). Internal learning involves a process of developing or creating knowledge based on a company's own experience, whilst external learning refers to a process of acquiring or absorbing knowledge available externally to the organisation. Four internal and four external learning mechanisms were examined to understand the extent and dynamics of knowledge acquisition practice in construction companies. Three hypotheses were postulated around this concept mainly to explore the relationship between internal/external learning and learning competence, and the impact of imbalance learning and organisational effectiveness.

Hypothesis 1

High learning companies are more likely to engage in a more balanced use of internal and external learning mechanisms than are low learning companies

The research found inconclusive evidence to support this hypothesis. Instead, evidence suggests that differences in the use of internal and external learning consistently occur between companies due to differing characteristics such as size and category of construction activity, not due to their learning competencies. This supports the finding of earlier studies by Damanpour (1996) and Bierly and Daly (2007) who show the influence of company size on the practice of internal and external learning. According to these findings, larger companies usually have more control over their external environment, more comprehensive practice of various learning activities, and more resources to develop technological capabilities. In addition, the present research found companies engaged in general contracting activity to be stronger in their practice of external learning than companies engaged in specialty contracting activity. This result is in parallel with the conclusion of Weerawardena *et al.* (2006) that companies operating in a more unstable environment, characterised by discontinuous activities, tend to place a major emphasis on externally focused learning in their knowledge acquisition efforts.

The present study also found that all companies in the sample reported considerably high usage of internal learning mechanisms. This is particularly consistent with an earlier study by Ozorhon *et al.* (2005) who found that construction companies learn

more from internal sources than external sources. A similar finding is also reported by Matzdorf and Price (2000) from UK quantity surveying organisations who found that the practice of internal learning such as through *internal exchange* and *self development* are more prevalent throughout successful and random companies in their study.

Hypothesis 2

Construction companies that exhibit more balanced practices between internal and external learning are more effective than are those that do not.

There is considerable evidence that is supportive of this hypothesis. For example, Company C had the most comprehensive practices of internal and external learning and was recorded as the most profitable among other general contractors in the sample. On the other hand, Company E, which had similar characteristic to Company C but was considerably weaker in its external learning, was later found to have gone out of business just a year after the original study was completed. Company F reported the same experience as Company E, even though it once claimed to be the most profitable company in the sample as was detailed in Chapter 5. Similar findings are reported by various researchers from different industries (Pascale, 1984; Levitt and March, 1988; Henderson, 1996; Tushman and O'Reilly, 1996). According to their studies, many companies discover that concentration on the exploitation of known and internally-developed alternatives at the expense of the exploration of the new and the unknown is self-destructive. For example, consider how the U.S. car industry fell into a competency trap during the 1970s and early 1980s because "it got stuck on the local performance hill of producing large cars for the U.S. market" (Levitt and March, 1988). Another famously cited case is Honda, which had been described as successful in penetrating the U.S. motorcycle market because of its ability to integrate both "focused attention" (internal learning) and "peripheral vision" (external learning) (Pascale, 1984). This seems also consistent with Zack's (1999) conclusion that, in order to survive in an ever changing environment, companies should maintain a balance between internal and external learning. Focusing on developing capability based on internal knowledge alone is not enough (Abbot *et al.*, 2006). Activities that support external learning must also be equally considered. Zack (1999) goes further in suggesting that competencies based on internally developed knowledge without being sufficiently adapted to the external

environment cannot be economically sustained over the long run. This assertion is borne out by the findings of this study.

Hypothesis 3

Construction companies that focus heavily on exploiting knowledge from internal sources without sufficiently exploring external knowledge are more likely to experience superstitious learning.

Superstitious learning occurs when organisational learning is ‘incomplete’ (March and Olsen, 1975). This seems apparent in the findings from Company F. The company shows an extremely limited practice of external learning whilst strongly developed in the area of internal learning. This has led the company to experience a tragic year that damaged its profitability and was even followed by a change in ownership and re-definition of its market orientation. Based on the information provided by the former director of Company F, there is a clear impression that the company had just undergone a kind of superstitious learning caused by insufficient mapping of the external environment (March and Olsen, 1975; Levitt and March, 1988). The reasons for a company ignoring the need of external learning can be varied, including the pursuit of efficiency and limited rationality (Liu, 2006). There is a natural tendency that when a company achieves success, it will continue to exploit the strategies that worked in the past (Audia *et al.*, 2000). This is especially true for a construction company engaged in repeat business or having standardised products. Typically, such strategic persistence is beneficial, as is clearly evident in Company F, which once claimed to be the most profitable company in the sample. However, such success-persistence-success cycles can become self-destructive when external changes impose the need to use new strategies. Unfortunately, a company marked by highly internal focus is more likely to build isolating mechanisms making it unable to detect early on the changes in the markets, as was the case in Company F. In itself, this latter finding provides another empirical support to the proposed descriptive model that identified the characteristics of the *internally-focused learning organisation* established in Table 5.44.

6.1.2 Knowledge Sharing

Knowledge sharing in an organisation is attainable through formal and informal mechanisms (DiBella *et al.*, 1996; Jordan and Jones, 1997; Tsai, 2002). Six formal learning mechanisms and another six informal learning mechanisms were examined to understand the extent and dynamics of knowledge sharing practices in construction companies. Two hypotheses were postulated mainly to explore the effect of company size and geographical dispersion on the choice of formal/informal learning mechanisms.

Hypothesis 4

Smaller and collocated companies are more likely to rely on the use of informal knowledge sharing mechanisms than are larger and geographically dispersed companies.

The findings from the present study provided considerable support to this hypothesis. Indeed, evidence consistently revealed that smaller construction companies tend to emphasise the use of informal mechanisms to support the process of knowledge sharing in the company (see *Table 5.44*). The use of formal mechanisms tends to be minimal in all cases. There is no distinction in such practice between higher and lower learning competence groups. The exchange of knowledge chiefly takes place in an opportunistic manner involves primarily internal rather than external sources. When information or knowledge is required for dealing with a new problem, engineers in a small company will ask associates on their informal organisational networks (Jordan and Jones, 1997). This result is consistent with Carrillo and Chinowsky's (2006) study, which found that smaller construction companies had a much heavier reliance on personal contact and "gurus" than on formal networks. According to their findings, smaller construction companies find it more cost effective to rely on local, accessible pools of knowledge and thus do not need the sort of advanced IT and formal infrastructure required by the larger companies.

Hypothesis 5

Larger and geographically dispersed construction companies are more likely to rely on the use of formal knowledge sharing mechanisms than are smaller and collocated companies.

There is consistent evidence that supports this hypothesis. Larger and geographically dispersed construction companies rely more on the use of formal mechanisms to facilitate the spread of knowledge between employees or between units. However, the use of informal mechanisms remains high in addition to their formalised mechanisms. There is no solid distinction in such correlation between higher and lower learning competence groups. In contrast with the practice in smaller companies, knowledge sharing in larger companies is characterised by both facilitating the exchange of tacit and explicit knowledge. Whereas Hansen *et al.* (1999) suggest that successful companies focus almost exclusively on either facilitating the exchange of tacit or explicit knowledge, this study finds no evidence of such polarisation, especially in the case of larger companies. Instead, the difference in practices of knowledge sharing consistently occurs between companies that engaged in more repetitive activities (specialty contracting) and companies that engaged in higher degree of uncertainties (general contracting). The former tend to be richer in their portfolios of mechanisms that facilitate the exchange of explicit (codified) knowledge, whilst the latter tend to be richer in the exchange of tacit knowledge. This is in line with Miles and Snow's (1978) model of strategic type, which equates formality to routinisation and informality to personalisation. According to this model, a company engaged in repetitive activities tend to formalise its activities through routinisation in order to achieve maximum efficiency, whilst a company engaged in less repetitive activities tends to support informality through personalisation in order to achieve greater flexibility. All large construction companies in the sample, regardless of their category of contracting activity, are equally strong in three knowledge sharing practices: the use of *company newsletters*, *lessons learned databases*, and the use of *standardisation of methods and best practices*; all of which are categorised under 'codified formal mechanisms' (see Table 5.45).

In the case of sharing contextual knowledge, which cannot be codified, large companies formalise the use of *inter-project visits* to allow the transfer of best practice knowledge between projects. This is evident in all companies in the sample with only marginal variations due to differing characteristics of individual company.

6.1.3 Knowledge Retention

Knowledge retention in an organisation is attainable through personalisation and codification mechanisms (Hansen *et al.*, 1999). Personalisation mechanisms are built upon a principle that ‘people’ and ‘networks’ that connect people are perhaps the most effective means for storing an organisation’s memory (Simon, 1991). Codification mechanisms, on the other hand, emphasise the separation of knowledge from the individuals who developed it and store it in a codified form so that it becomes available to everyone (Hansen *et al.*, 1999). Six personalised retention mechanisms and six codified retention mechanisms were examined to understand the extent and dynamics of knowledge retention practices in construction companies. Two hypotheses were postulated in this theme mainly to explore the effect of task related environments on the choice of personalisation/codification mechanisms.

Hypothesis 6

Codification mechanisms for retaining knowledge are more suitable for construction companies handling projects or encountering problems that are more standardised and repetitive in nature.

The findings from this study are supportive of the stated hypothesis. Empirical evidence suggests that construction companies engaged in specialty contracting activity tend to place a stronger emphasis on the use of codified mechanisms to facilitate the dissemination of knowledge in the company. This finding is in accord with Hansen *et al.*’s (1999) suggestions that companies offering standardised products and services – products/services that do not vary much, if at all – should follow the codification strategy. According to Hansen *et al.* (1999), an effective company tends to stick only on one strategy, either to use codification or personalisation, and maintains to do so even as new products/services became mature. However, the present study finds no clear evidence to support the latter. Instead, the study finds that smaller and larger

construction companies of the same category of contracting activity share a common practice in three mechanisms: *use of codified information*, *use of personal notes* and *personal case writings*; all of which are categorised as *codified informal mechanisms* (see Table 5.45)

Hypothesis 7

Personalisation mechanisms for retaining knowledge are more suitable for construction companies handling projects or encountering problems that are more customised and unique in nature.

The findings from this study also support this hypothesis, which is consistent with the previously analysed hypothesis. The findings with regard to knowledge sharing and retention were well summarised in Table 5.46. Empirical evidence suggests that construction companies engaged in general contracting activity tend to place greater emphasis on using personalisation mechanisms for disseminating knowledge. Again, this finding is consistent with Hansen *et al.*'s (1999) well known model. Hansen *et al.* (1999) propose that companies selling highly customised products and services should follow the personalisation model. Companies engaged in general contracting activity tend to have more diverse activities in terms of project types and sizes, therefore, codified knowledge is of limited value. The personalisation model emphasises facilitating the flows of tacit knowledge from person-to-person, rather than person-to-documents. Companies following the personalisation model also use electronic documents but the purpose is not to objectify knowledge, rather to facilitate the meeting between people such as through virtual media.

6.2 Empirical Validation of Research Propositions

The research journey began with propositions that have set the direction for the main contributions. These were addressed thoroughly in the previous section and are validated conclusively in the section that follows.

Proposition 1: There is a variation in the learning strategies and learning profiles adopted by construction companies.

This proposition is confirmed empirically through the analysis of findings in Sections 5.4. Summary sheets in *Tables 5.36, 5.37, 5.38, and 5.39* in Chapter 5 provide vivid and composite evidence that supports this proposition. In themselves the tables speak of the various learning strategies that manifest in the learning profiles adopted by the sample companies. Hansen *et al.* (1999) note that an effective learning strategy of a company reflects its competitive strategy, *i.e.* how it creates value for its markets, how that value supports an economic model, and how the company's people deliver on the values and the economics. This is clearly evident in the case of UK construction companies as represented by the sample of excellent companies participated in this study. Presented in *Table 6.1* are two distinct approaches for managing learning of construction companies adopted by the sample in the present study. Examples of companies that adopted each of these approaches are included in the table.

Table 6.1
Typology of construction companies learning:
How UK construction companies manage their learning

<i>Externally-focused learning organisation</i>		<i>Internally-focused learning organisation</i>
Operate in a broad and continuously developing market. Develop competencies based on multiple and prototypical technologies.	<i>Competitive strategy</i>	Operate in a narrow but well defined market. Develop competency based on single core technology.
Focus on generating large overall revenues. Reorganise the composition of project teams for each new project.	<i>Economic model</i>	Focus on maintaining high profit margins. Project teams stay together for different projects.
Extensive use of various learning mechanisms, characterised by a balanced use between internal and external learning. Emphasis on personalisation model.	<i>Learning strategy</i>	Intensive use of selected learning mechanisms, characterised by a highly focus on internal learning. Emphasis on codification model.
Companies C, D, E and G	<i>Examples</i>	Companies F, J and K

Proposition 2: Successful construction companies use different combinations of learning mechanisms.

This proposition is confirmed by the findings analysed in Sections 5.4, and was further explored in the hypotheses testing in Section 6.1. *Tables 5.43 and 5.45* in Chapter 5 are an extract of findings that provide empirical supports for this proposition. The tables expose selected construction companies that are considered fit to represent best practice models in their respective type and size. From the tables it is clear that a successful construction company employed a unique combination of learning mechanisms in line with its strategic posture. A construction company that positioned itself in a narrow but well defined market tends to build an isolating mechanism through a limited use of external learning, whilst highly focused on internal learning. Its knowledge sharing/retention model falls into either *codified informal mechanisms* or *codified formal mechanisms* or a combination of both. On the other hand, a construction company that positioned itself in a broad and continuously developing market tends to build more flexible technologies coupled with an extensive and balanced practice between internal and external learning. Its knowledge sharing/retention model falls predominantly into either *personalised informal mechanisms* or *personalised formal mechanisms*, but larger companies tend to adopt *fully formalised mechanisms*.

Proposition 3: The construction companies' use of a set of sharing mechanisms is contingent on the nature of basic organisational features such as company size and geographical dispersion as well as on the characteristics of works in which the company specialises.

This proposition is confirmed by the findings analysed in Sections 5.4 and was partly addressed in the previous sections. The section of '*best practice models for managing knowledge sharing and retention*' in Chapter 5 provided a detail analysis of the effect of company size, geographical dispersion and category of contracting activity with regard to the choice of knowledge sharing portfolio. The findings revealed four different portfolios of knowledge sharing/retention mechanisms uniquely practiced by construction companies: (1) *personalised informal mechanisms*, (2) *codified informal mechanisms*, (3) *codified formal mechanisms*, and (4) *personalised formal mechanisms*.

Each portfolio consists of different combinations of knowledge sharing/retention mechanisms. The *PERSONALISED INFORMAL MECHANISM* portfolio consists of three mechanisms: *social meetings and informal gathering*, *personal networking*, and *use of storytelling*. The *CODIFIED INFORMAL MECHANISM* portfolio consists of three mechanisms: *onsite information exchange*, *exchange of personal notes*, and *the use of voluntary case writing*. The *CODIFIED FORMAL MECHANISM* portfolio consists of three mechanisms: *use of company newsletters*, *lessons learned databases*, and *use of standardisation of methods and best practices*. The *PERSONALISED FORMAL MECHANISM* portfolio consists of three mechanisms: *formalised communities of practices*, *use of inter-project visits*, and *use of intranets*.

Based on the findings analysed in Chapter 5, it is clearly evident that successful construction companies tend to adopt a certain portfolio of mechanisms in line with their strategic posture and company size. Table 6.2 provides a map of knowledge sharing/retention portfolios, including a recommendation of the type of company that is most appropriate to adopt based on the practice of construction companies in the sample. This framework may be used by construction directors/managers to (re)design their knowledge sharing/retention practices in order to fit in with their strategic posture and economic model.

Table 6.2
Knowledge sharing portfolio:
A framework for managing knowledge sharing/retention in construction companies

	Formal	Informal
Personalised	<u>Quadrant 4:</u> <i>Personalised formal mechanisms</i> Most appropriate for: <i>Large and geographically dispersed companies that engage in general contracting business</i>	<u>Quadrant 1:</u> <i>Personalised informal mechanisms</i> Most appropriate for: <i>Small/medium-sized and collocated companies that engage in general contracting business</i>
Codified	<u>Quadrant 3:</u> <i>Codified formal mechanisms</i> Most appropriate for: <i>Large and geographically dispersed companies that engage in a specialty contracting business</i>	<u>Quadrant 2:</u> <i>Codified informal mechanisms</i> Most appropriate for: <i>Small/medium-sized and collocated companies that engage in a specialty contracting business</i>

6.3 Contribution to Knowledge

Organisational learning research is relatively new in the construction industry. This research has significantly added to the existing body of knowledge in the domain of organisational learning practice by developing a construction specific model for mapping organisational learning. The first model (the three radar diagrams; see *Figures 5.9, 5.10 and 5.11*) was developed through an extensive cross-disciplinary literature review, but with prudent consideration of its applicability to construction companies. Each element (the learning mechanisms) in the model was carefully selected: only those that were relevant and commonly used by construction companies as informed by the existing literature were employed. The model was tested empirically and was confirmed by construction directors/managers involved in the research as a useful diagnostic tool for evaluating the practice of organisational learning.

One of the commonly cited problems with the implementation of organisational learning is the lack of a practical tool for evaluating the practice of learning in a company (Goh and Richards, 1997). The proposed model is therefore a concrete contribution in that direction as well. The organisational learning profiles that resulted from the original model (the three radar diagrams) could provide a pictorial model that illustrate to managers of a construction company where their learning efforts had been focused with respect to the use of various learning mechanisms in their company. Furthermore, the potential use of the latter model (the learning profiles) was explored and proved to be useful for best practice benchmarking, which involved looking at the practices of organisations regarded as best in their learning.

An interpretative analysis on the best practice models of excellent companies in the sample generated new testable descriptive models: *the typology of construction companies learning* (Tables 5.44 and 6.1) and *the knowledge sharing portfolios* (Table 6.2). The former describes two different approaches to how construction companies manage their learning in line with their competitive strategy and economic model. The latter proposes four different portfolios of sharing mechanisms that may be used as a suggestive framework for managing knowledge sharing/retention in construction companies. These models were developed based on selected best cases, which were then evaluated against the remaining cases in the sample for validation purpose. Ultimately, the proposed descriptive models represent the critical contribution generated from this research.

In addition, there is little known about the extent and nature of the learning profiles currently being used by UK construction companies and this research also offers a novel insight in that perspective. To summarise the specific contribution that this thesis has made to existing knowledge, the following points are worth making:

- Organisational learning practice does vary significantly across construction companies of different size and different category of contracting activity.
- Major factors of organisational learning practice include: internal learning mechanisms, external learning mechanisms, formal learning mechanisms, informal learning mechanisms, personalised learning mechanisms and codified learning mechanisms.
- A radar diagram model (*Figures 5.9, 5.10 and 5.11*) composed of paired learning mechanisms (*e.g.* internal versus external learning mechanisms) can effectively generate a graphical model that exposes the organisational learning profiles of a construction company.
- The espoused organisational learning profiles of a company reflect its competitive strategy and can powerfully predict the current state of learning in the company.
- The learning of a construction company can be described in terms of a two-category typology, namely externally-focused learning and internally-focused learning (*Tables 5.44 and 6.1*).
- More successful construction companies tend to stick with one learning strategy to fit in with their competitive strategy and their choice of economic model.
- The knowledge sharing and retention mechanisms adopted by a construction company can be grouped in terms of four portfolios, namely personalised informal mechanisms, codified informal mechanisms, codified formal mechanisms, and personalised formal mechanisms (*Table 6.2*).
- More successful construction companies tend to pursue a focused application on one or two portfolios of sharing mechanisms to suit to their specific needs considering their size and geographical dispersion as well as their category of contracting activity.
- Organisational effectiveness is not directly linked with organisational learning competence, but is more associated with the fitness between the learning strategy and competitive strategy.

- Organisational learning is not necessarily intentional. For some companies, some aspects of organisational learning can be very deeply ingrained within their business practices, so deeply that even their managers cannot perceive their presence. This is clearly reflected in the results of the follow-up evaluation, where only 36% of the responding directors/top managers claimed their companies' learning profiles were the results of conscious strategic efforts. In fact, some companies that claimed otherwise are among those highly respected and successful in their respective fields. Indeed, their learning profiles demonstrated excellent fit to the idealistic model described previously. See for example the learning profiles of Companies I and K (*Table 5.46*), where their managers perceived that these were not the result of intentional strategic planning.

Overall, this thesis has provided further empirical evidence supporting the established assumption set in Chapter 1 that “all organisations learn” (Kim, 1993) and has provided some immediate steps in developing a useful taxonomy of construction company learning and the knowledge sharing portfolios. The findings have obvious practical implications and provide some pointers for construction directors/managers who are concerned with implementing effective organisational learning systems.

6.4 Implication for Practice

The research has several implications for construction companies that seek to improve performance through more effective organisational learning. Clearly, investment in building organisational learning competence alone is not sufficient to produce successful business performance. Construction managers should attempt to integrate their learning strategy with their company's competitive strategy. Whilst an externally-focused learning company can operate *effectively* in a broad and continuously developing market, an internally-focused learning company proved more *efficient* in operating in a narrow but well defined market. Surely, greater benefits can be derived from effective organisational learning systems and practices by ensuring that they are aligned with the company's core competitive strategy.

For that purpose, construction managers may use the radar diagram models proposed in this research for mapping and evaluating their current state of organisational learning practice and benchmark them against the best practice models developed in this thesis.

6.5 Reflections on the Research Approach

The main methodological challenge taken up by this thesis has been the possibility of integrating the adoption of quantitative research with case study research. Traditionally, it is often contended that quantitative research is associated with survey methods whilst the case study approach is associated with qualitative research (Yin, 1994). In fact, there is a sort of theoretical distance between organisational learning theories developed from prescriptive paradigms that are rarely tested in practice and theories developed from descriptive paradigms that are often based on a single case study. This thesis developed a proven systematic approach underlying an inquiry into organisational learning practice of construction companies that integrate, but also improve, these two. This approach includes the use of comprehensive 'literature search' for establishing the conceptual framework, the 'business environment audit' for establishing the context of the sample population, the 'learning competence test' for sample validation, the use of 'statistical techniques' for establishing correlation, and the conduct of 'cross-case comparison' and 'pattern-matching analysis' for model development.

Admittedly, the study was rather limited in terms of the size of its sample. Whilst it was designed to be so for the reasons mentioned in Chapter 1, it proved inadequate for further exploratory analysis such as using multiple regression and structural equation modelling. Nonetheless, the sample size of 30 companies and 72 subjects from 12 selected case companies was adequate for the purpose of the present study and did achieved its purpose, that is, to develop a construction specific model of successful organisational learning practice.

6.6 Recommendations for Future Research

Organisational learning in construction is an area of research that requires further theory developments. This research is one step towards contributing in that direction. Future research could examine the nature of relationships between the organisational learning strategy and the competitive strategy identified in this study. By focusing on particular aspects of learning strategy and obtaining a larger survey sample from a wider population, the interrelationship between learning strategy and competitive strategy and their impact on overall organisational performance could be investigated in greater depth.

Further research into the taxonomy of construction company learning and the knowledge sharing portfolios could provide new insights and perhaps develop prescriptive models that can be applied in practice. Additionally, there is scope for pure qualitative research that through, for example, more detailed case studies using “ethnographic methods” (O’Reilly, 2005), could develop further insights into the relationships that have been investigated and quantified in this study.

6.7 Chapter Conclusions: Final Reflections

This concluding chapter has discussed the main findings of the research in the context of existing theory through hypotheses testing and validation of research propositions. In this respect, the study has conclusively achieved its primary goal *to inquiry into the inner practices of organisational learning within the construction companies setting*. Among the major achievements were the development of radar diagram models for mapping and modelling organisational learning practice, the production of construction companies' learning profiles for benchmarking purpose, and the generation of two descriptive models (the typology of construction company learning and the knowledge sharing portfolios) for theory developments.

However, as highlighted in the previous section, some aspects of these findings still need further exploration. In particular, the proposed descriptive models need to be applied and tested in different settings involving larger samples or requiring more detailed investigation in order to establish a valid theory of organisational learning in construction. Indeed, it is hoped that the results of this research may serve as a springboard to encourage further research in the area concerned, which almost a decade ago was voiced by Sir John Egan of UK Construction Task Force in 1998, but is still valid today.

Due to the scope of the research, findings about UK construction companies may not hold true for companies operating in other markets. However, by applying the given research template, similar studies can be carried out in other settings and comparisons can be made.

Appendices

Appendix 1 The Business Environment Audit Questionnaire

Appendix 2 The Company Learning Competence Questionnaire

Appendix 3 Structured Interview Protocol

Appendix 4 Follow-up Questionnaire on Learning Profiles

Appendix 1: The Business Environment Audit Questionnaire

Organisational Learning in Construction

School of the Built Environment

Research project

In Association with Constructing Excellence North East



In order to contribute to the mission of improving the Construction Industry, we are trying to seek a better understanding of how organisations learn and develop. As part of this major research, we wish to identify a representative sample of contracting organisations from the members of Constructing Excellence. It would be of great assistance if you could answer the following short questionnaire. Please be assured that the replies are for academic purposes only and no individual company will be identified. Please tick one box in each case.

1. Name of Company:						
2. Geographical Area: Where is most of your work?	North East		National		International	
3. Category of construction activity Is your company?	General Contracting	Civil Engineering	M/E Subcontracting	Other Specialty / Subcontracting		
4. Sector: Is it usually?	Public Sector			Private Sector		
5. Type of work: Most common type of work?	Housing	Infra-structure	Public Building	Private Industrial	Private Commercial	Others
6. Construction: Is it usually?	New Build			Refurbishment		
7. Size: Most of your projects? Largest project since 2000?	Up to £250,000	£250,001-£500,000	£500,001-£1,000,000	£1,000,001-£5,000,000	£5,000,001-£10,000,000	More than £10,000,001
8. Procurement: Most usual form?	Traditional tendering	Design and Build	PFI / PPI	Partnering	Others	
9. Employees: Number of direct employees?	1 - 15	16 - 50	51 - 100	101 - 250	> 250	
10. Project Teams: How many project teams at any one time?	< 5	5 - 10	11 - 15	16 - 20	> 20	
11. Organization: Generally –do project teams?	Stay together			Reform for each new project		
12. Future involvement: We of course will need to obtain further data in the future and would be grateful if you could support with this. Would you be prepared to be involved further in this research project?	Yes, we are able to participate				No, we are unable to participate	

If you require any further information please contact:

Dr. Bob Giddings 0191 227 4742

Suyanto Mahdiputra 0191 243 7695

Please email the completed form to: suyanto.mahdiputra@unn.ac.uk

or post to: Dr Bob Giddings
School of the Built Environment
Ellison Building
Newcastle upon Tyne NE1 8ST

Thank you for your help.

Appendix 2: The Learning Competence Test Questionnaire

Organisational Learning in Construction

School of the Built Environment

Research project

In Association with Constructing Excellence North East



Further to your response to our previous survey regarding the above, we thank you for your readiness to be involved in this research. This second round survey aims at measuring your *company's learning competence* with the objective of identifying a group of contracting organisations that can be analysed in depth. It would be of great assistance if you could complete the following short questionnaire. Be assured that the replies are for academic purposes only and no individual company will be identified. Please assess your company and mark the appropriate box [5 highest score to 1 lowest score] reflecting the practice of your company in the following areas. For your guidance, the description of each statement is given in the next page.

- 5 = Strongly agree
- 4 = Agree
- 3 = Neutral
- 2 = Disagree
- 1 = Strongly disagree

1)	In my company, rewards are given for every achievement	1	2	3	4	5
2)	In my company, considerable errors are tolerated	1	2	3	4	5
3)	In my company, there is a climate of openness	1	2	3	4	5
4)	In my company, everyone has a freedom of speech	1	2	3	4	5
5)	In my company, inquiry and dialog are normal practice	1	2	3	4	5
6)	In my company, experimentation and innovation are normal practice	1	2	3	4	5
7)	In my company, change is embraced by everyone	1	2	3	4	5
8)	In my company, the common values of employees are reflected in the company policies	1	2	3	4	5
9)	In my company, information is easily assessable for everyone	1	2	3	4	5
10)	In my company, personal development is fully supported	1	2	3	4	5
11)	In my company, informal learning for everyone is fully supported	1	2	3	4	5
12)	In my company, inter-personal and team interactions are fully promoted	1	2	3	4	5
13)	In my company, project teams are almost autonomous from home office	1	2	3	4	5
14)	Name of Company					
15)	Contact Person's details					

If you require any further information please contact:

Dr. Bob Giddings 0191 227 4742

Suyanto Mahdiputra 0191 243 7695

Please email the completed form to: suyanto.mahdiputra@unn.ac.uk

or post to: Dr Bob Giddings
School of the Built Environment
Ellison Building
Newcastle upon Tyne NE1 8ST

Thank you for your help.

Description of statements in the questionnaire

The Company Learning Competence Questionnaire provides you a measure to benchmark your company's learning competence level against the idealistic conditions for enabling effective organisational learning.

Q1	<i>In my company, rewards are given for every achievement</i>	<p>Does your company have a reward scheme for successful employees? In what mechanisms?</p> <p>Companies that score low on this item often perceive accomplishment as merely part of a task, and therefore see no special need for reward. Alternatively, they may reward individual accomplishment, but not recognise and support contributions to team or group achievements.</p> <p>Companies that score high challenge their employees to develop learning by providing various incentive and reward schemes such as an apprentice award scheme, employee of the year, performance-related pay, royalties in ideas, bonuses, and so on.</p>
	1 2 3 4 5	
Q2	<i>In my company, considerable errors are tolerated</i>	<p>If your employees do a mistake that lead to <u>minor</u> losses in finance and/or reputation, How is that dealt with? Do you sack the people involved? Or?</p> <p>Companies that score low often engage in a discussion of mistakes that results in punishment or sanctions against those identified as responsible after a search for someone to blame.</p> <p>Companies that score high promote a risk taking culture, where constructive errors and mistakes are tolerated and changed into useful learning.</p>
	1 2 3 4 5	
Q3	<i>In my company, there is a climate of openness</i>	<p>Conflict resolution, How is that dealt with? Do people in your company open to speak their concern?</p> <p>Companies that score low on this item may have norms of false politeness that emphasis conformity, and may have developed a culture of suspicion and distrust that blocks communication and the flow of information.</p> <p>Companies that score high have access to open communication, problems are shared, and debate and conflict are acceptable ways to solve problems.</p>
	1 2 3 4 5	
Q4	<i>In my company, everyone has a freedom of speech</i>	<p>How do employees feedbacks to the management being accommodated? What mechanisms?</p> <p>Companies that score low on this area may have a culture of fear and people are unwilling to express their views.</p> <p>Companies that score high provide mechanisms whereby people can convey their messages to management without fear.</p>
	1 2 3 4 5	
Q5	<i>In my company, inquiry and dialog are normal practice</i>	<p>How do your company encourage an open exchange of ideas? Do the people challenged to ask their colleague of what they do not know?</p> <p>Companies that score low on this item do not invite challenge or inquiry for understanding.</p> <p>Companies that score high encourage an open exchange of ideas and knowledge sharing.</p>
	1 2 3 4 5	
Q6	<i>In my company, experimentation and innovation are normal practice</i>	<p>How do you enabling employees to demonstrate self-initiatives in doing their job? Rather than waiting for instructions?</p> <p>Employees in the companies that score low on this item fear to experiment with something new and prefer to play safe. The company does not encourage people to take initiative in their work.</p> <p>In companies that score high, employees are encouraged to take risks and innovate and to get out of the habit of asking for permission and waiting for instructions.</p>
	1 2 3 4 5	

Continued

Q7	<i>In my company, change is embraced by everyone</i>	1 2 3 4 5	<p>Do employees in your companies are flexible in adopting new way of working? How far they resist?</p> <p>Companies that score low on this area tend to maintain old beliefs that lead to conservative behaviour and an unwillingness to experiment with new ideas.</p> <p>Companies that score high, their employees prepare to change the way they work.</p>
Q8	<i>In my company the common values of employees are reflected in the company policies</i>	1 2 3 4 5	<p>Do your employees have opportunity to contribute to major company decisions? In what practise or occasion, for example?</p> <p>Companies that score low in this aspect often centralise the development of company policies and then expect employees to comply with those policies.</p> <p>Companies that score high provide mechanisms that all members of the organisation are involved in the policy-making process.</p>
Q9	<i>In my company, information is easily assessable for everyone</i>	1 2 3 4 5	<p>Does the company publish information on the performance for the benefit of employees? E.g. Bulletin boards, internal publications, intranets, etc?</p> <p>In companies that score low on this item, there are few opportunities or resources available for the widespread public sharing of information.</p> <p>In companies that score high, their employees have access to all relevant information held by the company.</p>
Q10	<i>In my company, personal development is fully supported</i>	1 2 3 4 5	<p>Are the employees being encouraged to adopt CDP (Continuing Personal Development)? What incentives or resources do the company provides?</p> <p>Companies that score low on this item lack the budget or resources for personal development. If they train people, they may not consider employee's career aspirations and learning interests.</p> <p>Companies that score high provide opportunities, resources and guidance for personal development of their employees; company's career planning is aligned with individuals' learning needs.</p>
Q11	<i>In my company, informal learning for everyone is fully supported</i>	1 2 3 4 5	<p>Does the company provide space & resources for employees to extend their knowledge? By what means? Libraries, informal chatting?</p> <p>Companies that score low on this item do not sufficiently encourage informal learning, or tend to attach it to tangible organisational incentives. Time spent in informal learning is viewed as being taken away from real work.</p> <p>Companies that score high provide sufficient resource systems for informal learning such as libraries, learning centres, space for informal chatting and the exchange of stories.</p>
Q12	<i>In my company, inter-personal and team interactions are fully promoted</i>	1 2 3 4 5	<p>How do different departments communicate with each other? Through Internet, formal meeting, informal occasion? Provide more evidence...</p> <p>Companies that score low on this area may have a culture of suspicion. Hierarchy and status may also restrict the free flow of ideas and information.</p> <p>Companies that score high provide facilities for individuals, teams/groups, and sub-units to exchange information on expectations, and give feedback on goods and services received.</p>
Q13	<i>In my company, project teams are almost autonomous from home office</i>	1 2 3 4 5	<p>How much autonomy do your project teams have? Are they allowed to take decision with regard to some changes from the original plan?</p> <p>Companies that score low on this item restrict the freedom of project teams to alter and adapt their task execution on site, which in effect impedes any opportunity to innovate and improve their practices.</p> <p>Companies that score high provide sufficient authority and flexibility are to project teams on site to act and adapt their working strategies as needed, without long procedural formalities that can slow down the project delivery.</p>

Appendix 3: Full Data Collection Protocol

Investigating Learning in UK Construction Companies

Objective:

To investigate how construction companies manage their learning practices and to seek for proven mechanisms, patterns and model for effective organisational learning.

Method of data collection: Structured Interview

Targeted respondents: 1) Directors/Top Managers of construction companies
2) Middle Managers
3) Frontline Managers

Date of interview: at:AM/PM

Name of Company

Interviewee's details

Position

1) External Knowledge Acquisition Questions

The questions in this section investigate the extent of external learning practice in a company in terms of the use of the following mechanisms.

Use of Project Teams as Learning Sensors

To what extent does your company facilitate the project teams to function as learning sensors against the external world?

To a very great extent	To a large extent	To a moderate extent	To a small extent	Not at all

Use of Marketing Divisions to Learn the Markets

To what extent does your company facilitate the use of the marketing division to continuously monitor and learn the situation in the market?

To a very great extent	To a large extent	To a moderate extent	To a small extent	Not at all

Use of Special Expertise to Scan Outside World

To what extent does your company employ special expertise or buy ready-made knowledge as part of the company's external learning strategies?

To a very great extent	To a large extent	To a moderate extent	To a small extent	Not at all

Use of Benchmarking

To what extent does your company use benchmarking to learn from competitor performance?

To a very great extent	To a large extent	To a moderate extent	To a small extent	Not at all

Please provide some examples or evidence that support the mentioned activities:

.....

2) Internal Knowledge Acquisition Questions

The questions in this section investigate the extent of practice of internal learning in a company in terms of the following mechanisms.

Use of Quality Circles

To what extent does your company use quality circles as part of internal organisational learning activities?

To a very great extent	To a large extent	To a moderate extent	To a small extent	Not at all

Use of Project Reviews

To what extent does your company use project reviews to support organisational learning?

To a very great extent	To a large extent	To a moderate extent	To a small extent	Not at all

Use of Lessons Learned from Project Failures

To what extent does your company facilitate the use of lessons learned from project failures to improve subsequent projects?

To a very great extent	To a large extent	To a moderate extent	To a small extent	Not at all

Use of Lessons Learned from project Successes

To what extent does your company use the lessons learned from project successes to improve the overall organisational performance?

To a very great extent	To a large extent	To a moderate extent	To a small extent	Not at all

Please provide some examples or evidence that support the mentioned activities:

.....
.....
.....

3) Informal Knowledge Sharing Questions

The questions in this section investigate the extent of practice of knowledge sharing in terms of the following informal mechanisms.

Social Meetings and Informal Gatherings

How often do you take the opportunity to share knowledge in a social meeting or informal gathering?

Always	Often	Some-times	Rarely	Never

Personal Networking

How often do you use your personal networks for the exchange of knowledge or experiences that relate to your work?

Always	Often	Some-times	Rarely	Never

Informal Storytelling Sessions

How often are you involved in an informal storytelling session where you can share learning with others?

Always	Often	Some-times	Rarely	Never

Onsite Information Exchange

How often are you involved in the practice of sharing or exchanging information with your project team members?

Always	Often	Some-times	Rarely	Never

Exchange of Personal Notes

How often are you involved in the practice of exchanging personal notes for sharing knowledge with your colleagues?

Always	Often	Some-times	Rarely	Never

Voluntary Case Writings

How often do you share your written reflections about a project or task of which you have experience?

Always	Often	Some-times	Rarely	Never

Please provide some examples or evidence that support the mentioned activities:

.....

.....

.....

4) Formal Knowledge Sharing Questions

The questions in this section investigate the extent of practice of knowledge sharing in terms of the following formal mechanisms.

Formalised Communities of Practices

How often are you involved in the practice of sharing information or exchanging experiences with people you know share an interest related to your job?

Always	Often	Some-times	Rarely	Never

Inter-project Visits

How often do you promote or become involved in an inter-project visit to learn or share experiences?

Always	Often	Some-times	Rarely	Never

Use of Intranets

How often do you use intranets to search, send, store, and exchange information and to share knowledge?

Always	Often	Some-times	Rarely	Never

Company Newsletters

How often do you use company newsletters to update your knowledge or provide information to others?

Always	Often	Some-times	Rarely	Never

Lessons Learned Databases

How often do you use lessons-learned databases to solve the problems you encounter?

Always	Often	Some-times	Rarely	Never

Standardisation of Methods and Best Practices

How often are you involved in the practice of using or promoting standard methods or practices in doing your specific tasks?

Always	Often	Some-times	Rarely	Never

Please provide some examples or evidence that support the mentioned activities:

.....

5) Personalised Retention Questions

The questions in this section investigate the extent of practice of personalisation in a company through the following mechanisms.

Use of Stories

How often do you tell a story to your colleagues to convey a message that relates to your work?

Always	Often	Some-times	Rarely	Never

Personal Networks

How often do you rely on your personal networks to keep yourself updated with information or developments that relate to your work?

Always	Often	Some-times	Rarely	Never

Social Meetings and Informal Gatherings

How often do you engage in social meetings and informal gatherings to make yourself aware of what is going on in your work related issues?

Always	Often	Some-times	Rarely	Never

Communities of Practices

How often are you required by the people in your community of specialisation to inform others about things you know well?

Always	Often	Some-times	Rarely	Never

Project Sites

How often are you formally involved in the practice of exploiting knowledge embedded in project sites?

Always	Often	Some-times	Rarely	Never

Use of Intranets

How often do you store documents or information in the intranet to make them available for other people?

Always	Often	Some-times	Rarely	Never

Please provide some examples or evidence that support the mentioned activities:

.....

.....

.....

6) Codified Retention Questions

The questions in this section investigate the extent of practice of codification in a company through the following mechanisms.

Codified Information

How often do you produce written documents such as drawings, reports, sketches, and graphs in relation to your work?

Always	Often	Some-times	Rarely	Never

Personal Notes

How often do you take personal notes, for example, to record any important facts, decisions or actions in relation to your work?

Always	Often	Some-times	Rarely	Never

Personal Case Writings

How often do you take the opportunity to write down your personal reflections about a project or task you have experienced?

Always	Often	Some-times	Rarely	Never

Standardised Methods and Best Practices

How often are you involved in the practice of developing a standard method of doing something that relates to your work?

Always	Often	Some-times	Rarely	Never

Company Databases

How often are you required to produce information related to your work to be stored in the company databases?

Always	Often	Some-times	Rarely	Never

Company Newsletters

How often are you required to provide material or information related to your job to be published in your company newsletters?

Always	Often	Some-times	Rarely	Never

Please provide some examples or evidence that support the mentioned activities:

.....

.....

.....

Appendix 4: Follow-up Questionnaire on Learning Profiles



Dear Mr.

Further to our recent visit to your company, we thank you for your full cooperation in this research. It is with great pleasure herewith we present the result of our mapping on your organisational learning practice based on the information provided by you and your recommended managers. We would also like to take this opportunity to ask you for your assessment regarding the model presented. Therefore, we would be grateful if you could complete the following short questionnaire and make any comments you think pertinent. This questionnaire constitutes the last part in the series of investigations in this study.

Name of Company		
Knowledge acquisition profile [Here]	Knowledge sharing profile [Here]	Knowledge retention profile [Here]

1) Do the models [the organisational learning profiles] presented accurately reflect the current state of practice of organisational learning in your company?	Yes	No
2) Are they the results of intentional strategic planning of your company?	Yes	No
3) Do they reflect the ideal strategic learning for your organisation?	Yes	No
4) Are they useful for the purpose of mapping organisational learning practices of your organisation?	Yes	No
5) Comments?		

Please email the completed form to:

suyanto.mahdiputra@unn.ac.uk

or post to:

Suyanto Mahdiputra
School of the Built Environment, Northumbria University
Ellison Building, Ellison Place
Newcastle upon Tyne NE1 8ST
Tel: 0191 243 7695, Fax: 0191 227 3167

Thank you for your help.

References

Books
(A to Z)

Journals
(A-Z)

Research Reports
(A to Z)

Conference Papers
(A to Z)

Unpublished Works
(A to Z)

Recommended Further Reading
(A to Z)

References

Books

Abbott, R.F. (2001) *A Manager's Guide to Newsletters: Communicating for Results*, Airdrie, Canada: Word Engine Press.

Abranovic, W.A. (1997) *Statistical Thinking and Data Analysis Methods for Managers*, Reading, MA: Addison-Wesley.

Adler, P.S. and Cole, R.E. (1995) 'Designed for learning: A tale of two auto plants', in A. Sandberg (ed.) *Enriching Production: Perspectives on Volvo's Uddevalla Plant as an Alternative to Lean Production*. Avebury, Aldershot (UK), pp. 157-177.

Angle, H.L. (1989) 'Psychology and organizational innovation', in A. Van de Ven, H. Angle and M.S. Poole (eds.) *Research on the Management of Innovation*. The Minnesota Studies, New York: Harper & Row, pp. 135-170.

Antal, A.B. and Krebsbach-Gnath, C. (2001) 'Consultants as agents of organizational learning: The importance of marginality', in M. Dierkes, A. B. Antal, J. Child and I. Nonaka (eds.) *Handbook of Organizational Learning and Knowledge*. Oxford: Oxford University Press, pp. 462-483.

Argyris, C. and Schön, D.A. (1978) *Organizational Learning: A Theory of Action Perspective*. Reading, MA: Addison-Wesley.

Batik, A.L. (1989) *A Guide to Standards*. El Ranco Press.

Baumard, P. (1999) *Tacit Knowledge in Organizations*. London: SAGE.

Bazerman, M.H. and Watkins, M.D. (2004) *Predictable Surprises*. Boston, MA: Harvard Business School Press.

Beach, D.P. and Alvager, T.K.E. (1992) *Handbook for Scientific and Technical Research*. London: Prentice Hall.

Bennett, J. (2000) *Construction –The Third Way: Managing Cooperation and Competition in Construction*. Oxford: Butterworth-Heinemann.

Blackler, F. (2002) 'Knowledge, knowledge work, and organizations', in C.W. Choo and N. Bontis (eds.) *The Strategic Management of Intellectual Capital and Organizational Knowledge*. Oxford: Oxford University Press, pp. 47-64.

Boisot, M.H. (1995) *Information Space: A Framework for Learning in Organizations, Institutions and Culture*. London: Routledge.

Bon, R. and Crosthwaite, D. (2000) *The Future of International Construction*. London: Thomas Telford.

Boyd, D. and Robson, A. (1996) 'Enhancing learning in construction projects', in D. Langford and A. Retik (eds.) *The Organization and Management of Construction, Vol. 1: Managing the Construction Enterprise*. London: E & FN Spon.

- Brown, J.S., Denning, S., Groh, K. and Prusak, L. (eds.) (2005) *Storytelling in Organizations: Why Storytelling is Transforming 21st Century Organizations and Management*. Burlington, MA; Oxford: Elsevier Butterworth-Heinemann.
- Bryman, A. (1988) *Quantity and Quality in Social Research*. London: Routledge.
- Cain, C.T. (2003) *Building Down Barriers: A Guide to Construction Best Practice*. London: Spon Press.
- Callison, C. and Parcell, G. (2001) *Learning to Fly*. Oxford: Capstone Publishing Limited.
- Camp, R.C. (1989) *Benchmarking: The Search for Industry Best Practices that Lead to Superior Performance*. Milwaukee, WI: ASQC Quality Press.
- Campbell, P.A. (2001) *Learning from Construction Failures: Applied Forensic Engineering*. New York: John Wiley & Sons.
- CIRIA (1999) 'Sustainability construction: Future R&I requirements: Analysis of current position', *Report for the CRISP Sustainable Construction Theme Group*, pp. 1-17.
- Clark, H.H. and Brenna, S.E. (1996) 'Grounding in communication', in L.B. Resnick, J.M. Levine and S.D. Teasley (eds.) *Perspectives on Socially Shared Cognition*. Washington, DC: American Psychological Association, pp. 127-149.
- Collinson, V. and Cook, T.F. (2007) *Organizational Learning: Improving Learning, Teaching, and Learning in School System*. London: Sage Publications.
- Confucius (551-479BC) 'Without learning, the wise become foolish; by learning, the foolish become wise', in M.M. Dawson (ed.) *Wisdom of Confucius*. New edn. Branden Publishing, 1963.
- Construction Clients' Forum (1999) *Whole Life Costing: A Client's Guide*. London: Construction Clients' Forum,
- Construction Clients' Forum (2000) *Whole Life Costing: A Client's Guide*. London: Construction Clients' Forum.
- Cook, T. and Campbell, D. (1979) *Quasi-Experimentation: Design and Analysis Issues for Filed Settings*. London: Houghton Mifflin.
- Coolican, H. (1999) *Research Methods and Statistics in Psychology*. 2nd edn. London: Hodder & Stoughton.
- Creswell, J.W. (2003) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 2nd edn. Thousand Oaks, CA; London: Sage.
- Cyert, R.M. and March, J.G. (1963) *A Behavioral Theory of the Firm*. Englewood Cliffs, New Jersey: Prentice Hall.
- Daft, R.L. (1992) *Organizational Theory and Design*. St.Paul: West Publishing Company.
- Dainty, A., Qin, J. and Carrillo, P.M. (2005) 'HRM strategies for promoting knowledge sharing within construction project organizations: A case study', in A.S. Kazi (ed.) *Knowledge Management in the Construction Industry: A Socio-Technical Perspective*. London: Idea Group Inc, pp. 18-33.

- Dale, B.G. and Oakland, J.S. (1994) *Quality Improvement Through Standards*. 2nd edn. Stanley Thornes Publishers.
- Davenport, T.H. and Prusak, L. (1998) *Working Knowledge: How Organizations Manage What They Know*. Boston, MA: Harvard Business School Press.
- DeGeus, A. (1996) 'Planning as learning', in K. Starkey (ed.) *How Organizations Learn*. London: Thomson Business Press.
- DeGeus, A. (1997) *The Living Company: Growth, Learning and Longevity in Business*. London: Nicholas Brealey.
- Deming, W.E. (1986) *Out of the Crisis: Quality, Productivity and Competitive Position*. Cambridge: Cambridge University Press.
- Denning, S. (2001) *The Springboard: How Storytelling Ignites Action in Knowledge-Era Organizations*. Boston; Oxford: Butterworth-Heinemann.
- Denning, S. (2005) 'The role of narrative in organizations', in J.S. Brown *et al.* (eds.) *Storytelling in Organizations: Why Storytelling is Transforming 21st Century Organizations and Management*. Burlington, MA; Oxford: Elsevier Butterworth-Heinemann.
- Denton, J. (1998) *Organizational Learning and Effectiveness*. London: Routledge.
- Denzin, N. and Lincoln, Y. (eds.) (1994) *Handbook of Qualitative Research*. Thousand Oak, CA: Sage Publications.
- Dewey, J. (1938) *Experience and Education*. New York: Collier Books.
- DiBella, A.J. (2001) *Learning Practices: Assessment and Action for Organizational Improvement*. Upper Saddle River, NJ: Prentice-Hall,
- Dixon, N.M. (1999) *The Organizational Learning Cycle: How We Can Learn Collectively*, 2nd edn. Brookfield, Vermont: Gower.
- DTI (2004) *Construction Statistics Annual: 2004 Edition*. London: TSO.
- DTI (2006) *Construction Statistics Annual: 2006 Edition*. London: TSO.
- Easterby-Smith, M, Burgoyne, J and Araujo, L (eds.) (1999) *Organizational learning and the learning organization: developing in theory and practice*. London: Sage Publications.
- Easterby-Smith, M. and Araujo, L. (1999) 'Organizational learning: current debates and opportunities', in Easterby-Smith, M., Burgoyne, J., Araujo, L. (eds.) *Organizational Learning and the Learning Organization*. London: Sage.
- Egan, J. (1998) *Rethinking Construction: Report of the Construction Task Force*. London: DTI.
- Eigen, M. (1927-) 'A theory has only the alternative of being right or wrong; A model has a third possibility: it may be right, but irrelevant', in J. Mehra (ed.) *The Physicist's Conception of Nature*. Dordrecht: Reidel, 1973.
- Feld, J. and Carper, K. (1997) *Construction Failure*. New York: Wiley.
- Fellows, R. and Liu, A. (1997) *Research Methods for Construction*. Oxford: Blackwell Science.

- Flanagan, R., Ingram, I. and Marsh, L. (1998) *A Bridge to the Future: Profitable Construction for Tomorrow's Industry and Its Customers*. Reading Construction Forum. London: Thomas Telford.
- Garratt, B. (2000) *The Learning Organization: Developing Democracy at Work*. Rev. edn. London: Harper Collins Business.
- Gibson, P. (1982) *Quality Circles: An Approach to Productivity Improvement*. Oxford: Pergamon.
- Gilley, J.W., Dean, P. and Bierema, L. (2001) *Philosophy and Practice of Organizational Learning, Performance, and Change*. Cambridge, MA: Perseus Publishing.
- Gredler, M. E. (2005) *Learning and Instruction: Theory into Practice*. 5th edn. Upper Saddle River, NJ: Pearson Education.
- Grindley, P.C. (1995) *Standards Strategy and Policy: Cases and Stories*. Oxford: Oxford University Press.
- Hall, P. (1980) *Great Planning Disasters*. London: Weidenfeld and Nicolson.
- Hedberg, B. (1981) 'How organizations learn and unlearn', in P.C. Nystrom and W.H. Starbuck (eds.) *Handbook of Organizational Design*. Oxford University Press, pp. 3-27.
- Henderson, R.M. (1996) 'Technological change and the management of architectural knowledge', in M.D. Cohen and L.S. Sproull (eds.) *Organizational Learning*. Thousand Oaks, CA: Sage, pp. 359-376.
- Hodgkinson, G.P. and Sparrow, P.R. (2002) *The Competent Organization: A Psychological Analysis of the Strategic Management Process*. Buckingham: Open University Press.
- Hollifield, C.A. and Coffey, A.J. (2006) 'Qualitative research in media management and economics', in A.B. Albarran, S.M. Chan-Olmsted and M.O. Wirth (eds.) *Handbook of Media Management and Economics*. Mahwah, NJ: L. Erlbaum Associates, pp. 573-600.
- Hubbard, R., Henifin, M.S. and Fried, B. (1979) *Women Look at Biology Looking at Women: A Collection of Feminist Critiques*. Boston: G.K. Hall.
- Jewell, M. and Walker, D.H.T. (2005) 'Community of practice software management tools: A UK construction company case study', in A.S. Kazi (ed.) *Knowledge Management in the Construction Industry: A Socio-Technical Perspective*. London: Idea Group Inc, pp. 90-111.
- Juran, J.M. (1988) *Juran on Planning for Quality*. New York: Free Press.
- Kazi, A.S. (Ed.) (2005) *Knowledge Management in the Construction Industry: A Socio-Technical Perspective*. London: Idea Group Inc.
- Khan, I. (1996) *The Alchemy of Happiness*. Revised edition. East-West Publications.
- Knowles, M. (1950) *Informal Adult Education: A Guide for Administrators, Leaders and Teachers*. New York: Association Press.
- Knowles, M.S. (1975) *Self-directed Learning: A Guide for Learners and Teachers*. New York: Association Press.

- Kohlberg, L. (1981) *The Philosophy of Moral Development: Moral Stages and the Idea of Justice*. Essays on Moral Development Volume 1. San Francisco; London: Harper & Row.
- Kolb, D. (1984) *Experiential Learning: Experience as the Source of Learning and Development*. London: Prentice-Hall.
- Kotter, J. and Heskett, J. (1992) *Corporate Culture and Performance*. New York: Free Press.
- Latham, M. (1994) *Constructing the Team*. Final Report of the Government / Industry Review of Procurement and Contractual Arrangements in the UK Construction Industry. London: HMSO.
- Lave, J. and Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. New York: Cambridge University Press.
- Levy, M. and Salvadori, M. (1992) *Why Buildings Fall Down*. New York: Norman.
- Lewin, K. (1935) *A Dynamic Theory of Personality*. New York: McGraw-Hill.
- Litwin, G.H. and Jr.Stringer, R.A. (1968) *Motivation and Organizational Climate*. Boston: Harvard University.
- Maimonides, M. (1904) *A Guide for the Perplexed*. Translated by M. Friedlaender. 4th revised edn. New York: E.P. Dutton.
- Marquardt, M. J. (1996) *Building the Learning Organization – A Systems Approach to Quantum Improvement and Global Success*. New York: McGraw-Hill.
- Marsick, V.J. and Watkins, K.E. (1990) *Informal and Incidental Learning in the Workplace*. London: Routledge.
- Mason, J. (2002) *Qualitative Researching*. 2nd edn. London: Sage Publications.
- Maxwell, J.A. (1998) 'Designing a Qualitative Study', in L. Bickman and D.J. Rog (eds.) *Handbook of Applied Social Research Methods*. Thousand Oaks, CA: Sage Publications, pp. 69-100.
- McLuhan, M. (1964) *Understanding Media: The Extensions of Man*, Routledge & Kegan Paul.
- Miles, M. and Huberman, A. (1994) *Qualitative Data Analysis: A Sourcebook of New Methods*. London: Sage Publications.
- Miles, R.E. and Snow, C.C. (1978) *Organizational Strategy, Structure, and Process*. London: McGraw-Hill.
- Miller, J.G. (1978) *Living Systems*. New York: McGraw-Hill.
- Moingeon, B. and Edmondson, A. (eds.) (1996) *Organizational Learning and Competitive Advantage*. London: SAGE.
- Morgan, H. L. and Root, D. J. (1979) 'A concept of corporate memory', in *Office Automation Conference Proceedings*. New York University. New York.
- Moser, C. and Kalton, G. (1985) *Survey Methods in Social Investigation*. 2nd edn. Aldershot: Gower.

- Mouton, J. and Marais, H.C (1990) *Basic Concepts in the Methodology of the Social Sciences*. Rev edn. Pretoria: Human Sciences Research Council.
- Mumford, A. (1994) 'Individual and organizational learning: the pursuit of change', in C. Mabey, and P. Iles (eds.) *Managing Learning*. London: Routledge, pp. 77-86.
- Myers, P.S. (ed.) (1996) *Knowledge Management and Organizational Design*. Boston: Butterworth-Heinemann.
- NAO (2001) 'Modernising Construction', *Report by the Comptroller and Auditor General*. London: National Audit Office.
- Nelson, R.R. and Winter, S.G. (1982) *An Evolutionary Theory of Economic Change*. Cambridge, MA: Harvard University Press.
- Nonaka, I. and Takeuchi, H. (1995) *The knowledge creating company*. New York; London: Oxford University Press.
- O'Leary, Z. (2004) *The Essential Guide to Doing Research*. London: SAGE.
- O'Reilly, K. (2005) *Ethnographic Methods*. London: Routledge.
- Patton, M.Q. (1990) *Qualitative Evaluation and Research Methods*. London: Sage Publications.
- Peansupap, V. and Walker, D.H.T. (2005) 'Diffusion of information and communication technology: A community of practice perspective', in A.S. Kazi (ed.) *Knowledge Management in the Construction Industry: A Socio-Technical Perspective*. London: Idea Group Inc, pp. 90-111.
- Pearce, D. (2003) *The Social and Economic Value of Construction*. A Report for the Construction Industry Research and Innovation Strategy Panel. London: nCRISP.
- Pedler, M., Burgoyne, J. and Boydell, T. (1997) *The Learning Company: A Strategy for Sustainable Development*. 2nd edn. London: McGraw-Hill.
- Polanyi, M. (1962) *Personal Knowledge: Towards a Post Critical Philosophy*. London: Routledge.
- Pole, C. and Lampard, R. (2002) *Practical Social Investigation: Qualitative and Quantitative Methods in Social Research*. London: Prentice-Hall.
- Popper, K.R. (1992) *The Logic of Scientific Discovery*. London: Routledge.
- Probst, G. (2002) 'Putting knowledge to work: Case writing as an organizational learning and knowledge management tool for the new economy', in G. Probst, & T. H. Davenport (eds.) *Knowledge Management Case Book*. New York, NY: John Wiley and Sons, pp. 248-261.
- Probst, G. and Buchel, B (1997) *Organizational Learning: The Competitive Advantage of the Future*. London; New York, NY: Prentice Hall.
- Ragin, C.C. (1994) *Constructing Social Research: The Unity and Diversity of Method*. London: Pine Forge Press.
- Rajan, A., Lank, E. and Chapple, K. (1999) *Good Practices in Knowledge Creation & Exchange*. London: Focus Central London.

- Reaves, C.C. (1992) *Quantitative Research for The Behavioural Sciences*. Singapore: John Wiley & Sons.
- Reber, A.S. (1993) *Implicit Learning and Tacit Knowledge: an Essay on the Cognitive Unconscious*. Oxford: Oxford University Press.
- Rogoff, B. (1990) *Apprenticeship in Thinking: Cognitive Development in a Social Context*. New York; Oxford: Oxford University Press.
- Roscoe, J.T. (1975) *Fundamental Research Statistics for the Behavioral Sciences*. 2nd edn, London: Rinehart & Winston.
- Sanchez, R. (2005) 'Personal knowledge versus organizational knowledge approaches to knowledge management practice', in D. Rooney, G. Hearn and A. Ninan (eds.) *The Knowledge Economy Handbook*. Oxford: Routledge.
- Sanger, F. (1918-) 'A quote from Banquet Speech', in W. Odelberg (ed.) *The Nobel Prizes 1980*. Stockholm: Nobel Foundation.
- Saris, W.E. and Gallhofer, I.N. (2007) *Design, Evaluation, and Analysis of Questionnaires for Survey Research*. Hoboken, NJ; Chichester: Wiley.
- Schein, E.H (1985) *Organizational Culture and Leadership*. London: Jossey-Bass.
- Scott, W. R. (2001) *Institutions and Organizations*. 2nd edn. Thousand Oaks, CA: Sage Publications.
- Senge, P.M. (1990) *The Fifth Discipline: The Art and Practice of the Learning Organization*. London: Century Business.
- Senge, P.M., Kleiner, A., Roberts, C., Ross, R. and Smith, B. (1994) *The Fifth Discipline Fieldbook: Strategies and Tools for Building a Learning Organization*. London: Brealey.
- Shewhart, W.A. and Deming, W.E. (1986) *Statistical Method from the Viewpoint of Quality Control*. New York: Dover.
- Shukla, M. (1997) *Competing Through Knowledge: Building a Learning Organization*. New Delhi: Response Books.
- Siegel, S. and Castellan, J.N. (1988) *Non-parametric Statistics for Behavioural Sciences*. London: McGraw-Hill.
- Silverman, D. (2000) *Doing Qualitative Research: A Practical Handbook*. London: Sage Publications.
- Simon, H.A. (1976) *Administrative Behavior: A Study of Decision Making Processes in Administrative Organizations*. New York: Free Press.
- Sitkin, S.B. (1996) 'Learning through failure: The strategy of small losses', in M.D. Cohen & L.S. Sproull (eds.) *Organizational Learning*. Thousand Oaks, CA: Sage, pp. 541-578.
- Smith, K. (1982) 'Philosophical problems in thinking about organizational change', in P.S. Goodman (ed.) *Change in Organizations*. London: Jossey, pp. 316-373.

- Starbuck, W.H., Greve, H. and Hedberg, B. (1978) 'Responding to crisis', in C.F. Smart and W.T. Stanbury (eds.) *Studies on Crisis Management*. Montreal: Institute for Research on Public Policy, pp. 111-137.
- Stata, R. (1996) 'Organizational learning: the key to management innovation', in K. Starkey (ed.) *How Organizations Learn*. London: Thomson Business Press.
- Sutton, Howard. (1988) *Competitive Intelligence*. New York, NY: The Conference Board.
- Swan, W. and Kyng, E. (2004) *An introduction to Key Performance Indicators*. Centre for Construction Innovation. Manchester: Constructing Excellence in the North West.
- Trim, P.R.J. and Lee, Y-I. (2005) 'The role of marketing intelligence officers in strategy formulation and implementation', in Coate, P. (eds.) *Handbook of Business Strategy*. Bradford: Emerald Group Publishing Limited, pp. 125-130.
- Truch, E. (2004) *Knowledge Orientation in Organizations*. Hants, UK: Ashgate.
- Von Bertalanffy, L. (1968) *General System Theory*. New York: George Braziller, Inc.
- Von Krogh, G., Ichijo, K. and Nonaka, I. (2000) *Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation*. Oxford University Press.
- Wain, K. (1987) *Philosophy of Lifelong education*. London: Croom Helm.
- Walsh, J.P., Huff, A.S., Shrivastava, P. and Dutton, J. (eds.) (1997) *Advances in Strategic Management*. Vol. 14: Organizational Learning and Strategic Management. London: Greenwich.
- Walton, R. E. and Hackman, J. R. (1986) 'Groups under contrasting management strategies', in P. S. Goodman & Associates (eds.) *Designing Effective Work Groups*. San Francisco, CA: Jossey-Bass, pp. 168-201.
- Watkins, K., Marsick, V. (1999) *Facilitating Learning Organizations: Making Learning Count*. Aldershot: Gower Publishing Limited.
- Watkins, K.E. and Marsick, V.J. (1993) *Sculpting the Learning Organization: Lessons in the Art and Science of Systemic Change*. San Francisco, California: Jossey-Bass.
- Weick, K.E. (1979) *The Social Psychology of Organizing*. 2nd edn. Reading, MA: Addison-Wesley.
- Wenger, E. (1998) *Communities of Practice: Learning, Meaning, and Identity*. Cambridge University Press, New York
- Wenger, E., McDermott, R. and Snyder, W. (2002) *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Cambridge, MA: Harvard Business School Press.
- Yin, R.K. (1994) *Case Study Research: Design and Methods*. 2nd edn. Thousand Oaks, CA; London: Sage.
- Zuboff, S. (1988) *In the Age of the Smart Machine: The Future of Work and Power*. Oxford: Heinemann Professional.

Journals

- Abbot, C., Jeong, K. and Allen, S. (2006) 'The economic motivation for innovation in small construction companies', *Construction Innovation: Information, Process, Management*, 6(3), pp. 187-196.
- Abma, T.A. (2003) 'Learning by telling: Storytelling workshops as an organizational learning intervention', *Management Learning*, 34(2), pp. 221-240.
- Adams, G.L. and Lamont, B.T. (2003) 'Knowledge management systems and developing sustainable competitive advantage', *Journal of Knowledge Management*, 7(2), pp. 142-154.
- Adler, P.S. and Borys, B. (1996) 'Two types of bureaucracy: enabling and coercive', *Administrative Science Quarterly*, 41, pp. 61-89.
- Ahmad, I.U. and Sein, M.K. (1997) 'Construction project teams for TQM: A factor-element impact model', *Construction Management and Economics*, 15, pp. 457-467.
- Ahmed, S.M. and Kangari, R. (1995) 'Analysis of client-satisfaction factors in construction industry', *Journal of Management in Engineering*, 11(2), pp. 36-42.
- Akintoye, A. and Skitmore, M. (1991) 'Profitability of UK construction contractors', *Construction Management and Economics*, 9(4), pp. 311-325.
- Ali, I.M., Pascoe, C. and Warne, L. (2002) 'Interactions of organizational culture and collaboration in working and learning', *Educational Technology & Society*, 5(2), pp. 60-68.
- Almeida, P. and Kogut, B. (1999) 'Localization of knowledge and the mobility of engineers in regional networks', *Management Science*, 45, pp. 905-917.
- Amstrong, A. and Foley, P. (2003) 'Foundations for a learning organization: organizational learning mechanisms', *The Learning Organization*, 10(2), pp. 74-82.
- Andrews, K. M. and Delahaye, B. L. (2000) 'Influences on knowledge processes in organizational learning: The psychological filter', *Journal of Management Studies*, 37(6), pp. 797-810.
- Antonacopoulou, E. (2004) 'On the virtues of practicing scholarship: A tribute to Chris Argyris, a 'Timeless Learner'', *Management Learning*, 35(4), pp. 397-417.
- Appelbaum, S.H. and Gallagher, J. (2000) 'The competitive advantage of organizational learning', *Journal of Workplace Learning*, 12(2), pp. 40-56.
- Arditi, D., Koksall, A. and Kale, S. (2000) 'Business failures in the construction industry', *Engineering Construction and Architectural Management*, 7(2), pp. 120-132.
- Argote, L., and Eppler, D. (1990) 'Learning curves in Manufacturing', *Science*, 247(23), pp. 920-924.
- Argyris, C. (1977) 'Double-loop learning in organizations', *Harvard Business Review*, 55(5), pp. 115-129.
- Argyris, C. (1991) 'The use of knowledge as a test for theory: The case of public administration', *Journal of Public Administration Research and Theory*, 1(3), pp. 337-354.

- Atkinson, A.R. (1999) 'The role of human error in construction defects', *Structural Survey*, 17(4), pp. 231-236.
- Audia, P.G., Locke, E.A. and Smith, K.G. (2000) 'The paradox of success: An archival and a laboratory study of strategic persistence following radical environmental change', *Academy of Management Journal*, 43(5), pp. 837-853.
- Bailetti, A.J. and Callahan, J.R. (1995) 'Managing consistency between product development and public standards evolution', *Research Policy*, 24, pp. 913-931.
- Bailey, J.R., Saporito, P., Kressel, K., Christensen, E. and Hooihberg, R. (1997) 'A model for reflective pedagogy', *Journal of Management Education*, 21(2), pp. 155-167.
- Baldwin, A.N, Thorpe, A. and Carter, C. (1999) 'The use of electronic information exchange on construction alliance projects', *Automation in Construction*, 8(6), pp. 651-662.
- Ball, M. Farshchi, M. and Grilli, M. (2000) 'Competition and the persistence of profits in the UK construction industry', *Construction Management and Economics*, 18, pp.733-745.
- Barlow, J and Jashapara, A (1998) 'Organizational learning and inter-firm partnering in the UK construction industry', *The Learning Organization*, 5(2), 86-98.
- Barlow, J. (2000) 'Innovation and learning in complex offshore construction projects', *Research Policy*, 29(7/8), pp. 973-989.
- Bartlett, C.A. and Ghoshal, S. (1998) 'Beyond strategic planning to organization learning: Lifeblood of the individualized corporation', *Strategy & Leadership*, January/ February, pp. 34-39.
- Bassi, L., Cheney, S. and Lewis, E. (1998) 'Trends in workplace learning: Supply and demand in interesting times', *Training & Development*, 52(11), pp. 51-77.
- Bates, R. and Khasawneh, S. (2005) 'Organizational learning culture, learning transfer climate and perceived innovation in Jordanian organizations', *International Journal of Training and Development*, 9(2), pp. 96-109.
- Baumard, P. and Starbuck, W.H. (2005) Learning from failures: Why it may not happen', *Long Range Planning*, 38, pp. 281-298.
- Berends, H., Boersma, K. and Weggeman, M. (2003) 'The Structuration of Organizational Learning', *Human Relations*, 56(9), pp. 1035-1056.
- Bhatt, G.D. (2002) 'Management strategies for individual knowledge and organizational knowledge', *Journal of Knowledge Management*, 6(1), pp. 31-39.
- Bierley, P.E., Kessler, E.H. and Christensen, E.W. (2000) 'Organisational learning, knowledge and wisdom', *Journal of Organizational Change Management*, 13, pp. 595-618.
- Bierly, P.E. and Daly, P.S. (2007) 'Alternative knowledge strategies, competitive environment, and organizational performance in small manufacturing firms', *Entrepreneurship: Theory and Practice*, 4(31), pp. 493-516.
- Birnberg, J.G., Shields, M.D. and Young, S.M. (1990) 'The case for multiple methods in empirical accounting research (with an illustration from budget setting)', *Journal of Management Accounting Research*, 2, pp. 33-66.

- Boh, W.F. (2007) 'Mechanisms for sharing knowledge in project-based organisations', *Information and Organisation*, 17, pp. 27-58.
- Boje, D.M (1994) 'Organizational storytelling: the strugglers of pre-modern, modern and post-modern organizational learning discourses', *Management Learning*, 25(3), pp. 433-61.
- Bonifacio, M., Bouquet, P. and Cuel, R. (2002) 'Knowledge nodes: the building blocks of a distributed approach to knowledge management', *Journal of Universal Computer Science*, 8(6), pp. 652-661.
- Bood, R. and Postma, T. (1997) 'Strategic learning with scenarios', *European Management Journal*, 15(6), pp. 633-647.
- Bourgeois, J. and Eisenhardt, K. (1988) 'Strategic decision processes in high velocity environments: Four cases in the microcomputer industry', *Management Science*, 34, pp. 816-835.
- Boyce, ME. (1996) 'Organisational story and story telling: A critical review', *Journal of Organisational Change Management*, 9(5), pp. 5-26.
- Boyd, E. and Fales, A. (1983) 'Reflective learning: Key to learning from experience', *Journal of Humanistic Psychology*, 23(2), pp. 99-117.
- Brookfield, S.D. (1981) 'Independent adult learning', *Studies in Adult Education*, 13(2), pp. 59-71.
- Brown, J. and Duguid, P. (1991) 'Organisational learning and communities of practice: Toward a unified view of working, learning and innovation', *Organization Science*, 2(1), pp. 40-57.
- Brown, J. and Duguid, P. (1996) 'The social life of documents', *First Monday*, 1(1).
- Brown, J. and Isaacs, D. (1996) 'Conversation as a core business process', *The Systems Thinker*, 7(10), pp. 1-6.
- Buckler, B. (1998) 'Practical steps towards a learning organisation: Applying academic knowledge to improvement and innovation in business processes', *The Learning Organization*, 5(1), pp. 15-23.
- Buckley, P.J., Clegg, J. and Tan, H. (2006) 'Cultural awareness in knowledge transfer to China: The role of *guanxi* and *mianzi*', *Journal of World Business*, 41, pp. 275-288.
- Building (2003) *Tender Price Forecast*, 2 May.
- Busby, J.S. (1999) 'An assessment of post-project reviews', *Project Management Journal*, 30(3), pp. 23-29.
- Bush, V. (1945) 'As we may think', *The Atlantic Monthly*, July.
- Byrne, M. (2001) 'Interviewing as a data collection method', *AORN Journal*, 74(2), pp. 233-235.
- Camera, G., Reed, R.R. and Waller, C.J. (2003) 'Jack of all trades or a master of one? Specialization, trade, and money', *International Economic Review*, 44(4), pp. 1275-1294.
- Cangelosi, V and Dill, W R (1965) 'Organizational learning: observations toward a theory', *Administrative Science Quarterly*, 10(2), 175-203.

- Carlson, P.A. (2000) 'Information technology and the emergence of a worker-centered organization', *ACM Journal of Computer Documentation*, 24(4), pp. 204-212.
- Carrillo, P. (2005) 'Lessons learned practices in the engineering, procurement and construction sector', *Engineering, Construction and Architectural Management*, 12(3), pp. 236-250.
- Carrillo, P. and Chinowsky, P. (2006) 'Exploiting knowledge management: The engineering and construction perspective', *Journal of Management in Engineering*, 22(1), pp. 2-10.
- Cash, M. (1997) 'Stories within a story: Parables from The New Zealand Experiment', *The Learning Organization*, 4(4), pp. 159-167.
- Cavaleri, S.A. and Fearon, D.S. (2006) 'Integrating organizational learning and business praxis: A case for intelligent project management', *The Learning Organization*, 7(5), pp. 251-258.
- Chambers, S. and Johnston, R. (2000) 'Experience curves in services: Macro and micro level approaches', *International Journal of Operations & Production Management*, 20(7), pp. 842-859.
- Chandler, A.D. (1992) 'Organizational capabilities and the economic history of the industrial enterprise', *Journal of Economic Perspectives*, 6(3), pp. 79-100.
- Chandler, N., Keller, C., Lyon, W. (2000) 'Unraveling the determinants and consequences of an innovation-supportive organizational culture', *Entrepreneurship Theory and Practice*, pp.59-76.
- Cheah, C.Y.J., Kang, J. and Chew, D.A.S. (2007) 'Strategic analysis of local construction firms in China', *Construction Management and Economics*, 25(1), pp. 25-38.
- Chen, G. (2005) 'An organizational learning model based on Western and Chinese management thoughts and practices', *Management Decision*, 43(4), pp. 479-500.
- Chernev, A. (2007) 'Jack of all trades or master of one? Product differentiation and compensatory reasoning in consumer choice', *Journal of Consumer Research*, 33(4), pp. 430-444.
- Chiva, R. and Alegre, J. (2005) 'Organizational learning and organizational knowledge: towards the integration of two approaches', *Management Learning*, 36(1), pp. 49-68.
- Choe, J-M. (2002) 'The organisational learning effects of management accounting information under advanced manufacturing technology', *European Journal of Information System*, 11(2), pp. 142-158.
- Chuang, Y. and Baum, J.A.C. (2003) 'It's all in the name: Failure-induced learning by multiunit chains', *Administrative Science Quarterly*, 48, pp. 33-59.
- Coakes, E. (2006) 'Storing and sharing knowledge: Supporting the management of knowledge made explicit in transnational organisations', *The Learning Organization*, 13(6), pp. 579-593.
- Coates, N. (1994) 'Organizations as learning systems: The case of the Japanese automobile manufacturing industry', *The International Executive*, 36(2), pp. 171-187.
- Cohen, W.M. and Levinthal, D.A. (1990) 'Absorptive capacity: A new perspective on learning and innovation', *Administrative Science Quarterly*, 35(1), pp. 128-153.
- Cook, S.D.N., Yanow, D. (1993) 'Culture and organizational learning', *Journal of Management Inquiry*, 2(4), pp. 373-390.

- Costa, D.B., Formoso, C.T., Kagioglou, M., Alarcón, L.F. and Caldas, C.H. (2006) 'Benchmarking initiatives in the Construction Industry: Lessons learned and improvement opportunities', *Journal of Management in Engineering*, 22(4), pp. 158-167.
- Couto, J.P. and Teixeira, J.C. (2005) 'Using linear model for learning curve effect on highrise floor construction', *Construction Management and Economics*, 23, pp. 355-364.
- Cox, A., Thompson, I. (1998) 'On the appropriateness of benchmarking', *Journal of General Management*, 23(3), pp. 1-20.
- Cross, R., Nohria, N. and Parker, A. (2002) 'Six myths about informal networks and how to overcome them', *Sloan Management Review*, 43(3), pp. 67-75.
- Crossan, M and Guatto, M (1996) 'Organizational learning research profile'. *Journal of Organizational Change Management*, 9(1), pp. 107-112.
- Crossan, M. (2003a) 'Chris Argyris and Donald Schön's organizational learning: There is no silver bullet', *Academy of Management Executive*, 17(2), pp. 38-39.
- Crossan, M. (2003b) 'Altering theories of learning and action: An interview with Chris Argyris', *Academy of Management Executive*, 17(2), pp. 40-46.
- Crossan, M.M., Lane, H.W., & White, R.E. (1999) 'An organizational learning framework: From intuition to institution', *Academy of Management Review*, 24(3), pp. 522-537.
- Damanpour, F. (1996) 'Organizational complexity and innovation: Developing and testing multiple contingency models', *Management Science*, 42(5), pp. 693-716.
- Damsgaard, J. and Scheepers, R. (1999) 'Power, influence and intranet implementation: A safari of South African organizations', *Information Technology & People*, 12(4), pp. 333-358.
- Damsgaard, J. and Scheepers, R. (2000) 'Managing the crises in intranet implementation: A stage model', *Information Systems Journal*, 10(2), pp. 131-149.
- Darlington, J.F. and Booker, J.D. (2005) 'Development of design technique for the identification of fatigue initiating features', *Engineering Failure Analysis*, 13(7), pp. 1134-1152.
- Day, G.S. (1994a) 'The capabilities of the market-driven organization', *Journal of Marketing*, 58, pp. 37-51.
- Day, G.S. (1994b) 'Continuous learning about markets', *California Management Review*, 36, pp. 9-31.
- DeGeus, A.P. (1988) 'Planning as learning', *Harvard Business Review*, 66, pp. 70-74.
- De-la-Garza, J.M. and Howitt, I. (1998) 'Wireless communication and computing at the construction jobsite', *Automation in Construction*, 7(4), pp. 327-347.
- Delgado-Hernandez, D.J. and Aspinwall, E.M. (2005) 'Improvement tools in the UK construction industry', *Construction Management and Economics*, 23, pp. 965-977.
- Desouza, K.C. (2003a) 'Strategic contributions of game rooms to knowledge management: Some preliminary insights', *Information & Management*, 41(1), pp. 63-74.

- Desouza, K.C. (2003b) 'Facilitating tacit knowledge exchange: Sharing insights from a humanistic and entertaining approach to improving organizational efficiency', *Communication of the ACM*, 46(6), pp. 85-88.
- Desouza, K.C. and Evaristo, J.R. (2004) 'Managing knowledge in distributed projects', *Communication of the ACM*, 47(4), pp. 87-91.
- Dettwiler, P. (2006) 'Offices of Swedish growth firms: Facilities management variables', *Facilities*, 24(5/6), pp. 221-241.
- Dibella, A.J., Nevis, E.C. and Gould, J.M. (1996) 'Understanding organisational learning capability', *Journal of Management Studies*, 33(3), pp. 361-79.
- Diez, M., Soler, C., Sureda, M. and Visauta, B. (2005) 'Exploring the 'learning organization model' in multinational companies: Preliminary results according to the perception of Spanish managers', *Journal of European Industrial Training*, 29(4), pp. 292-311.
- Disterer, G. (2002) 'Management of project knowledge and experience', *Journal of Knowledge Management*, 6(5), pp. 512-520.
- Dixon, N.M. (1992) 'Organizational learning: A review of the literature with implication for HRD professionals', *Human Resource Development Quarterly*, 3(1), pp. 29-48.
- Dodgson, M. (1993) 'Organizational learning: a review of some literatures', *Organization Studies*, 14(3), pp. 375-395.
- Dunphy, D. Turner, D. and Crawford, M. (1997) 'Organizational learning as the creation of corporate competence', *Journal of Management Development*, 16(4), pp. 232-244.
- Dyer, J.H. and Nobeoka, K. (2000) 'Creating and managing a high-performance knowledge-sharing network: The Toyota case', *Strategic Management Journal*, 21(3), pp. 345-367.
- Easterby-Smith, M (1997) 'Disciplines of organizational learning: contributions and critiques', *Human Relations*, 50(9), pp. 1085-1113.
- Easterby-Smith, M, Crossan, M and Nicolini, D (2000) 'Organizational learning: debates past, present and future', *Journal of Management Studies*, 37(6), pp. 783-796.
- Easterby-Smith, M. (1997) 'Disciplines of organizational learning: Contributions and critiques', *Human Relations*, 50(9), pp. 1085-1113.
- Easterby-Smith, M. and Lyles, M. (2003) 'Re-reading organizational learning: Selective memory, forgetting, and adaptation', *Academy of Management Executive*, 17(2), pp. 51-55.
- Easterby-Smith, M., Antonacopoulou, E. Simm, D. and Lyles, M. (2004) 'Constructing contributions to organizational learning: Argyris and the next generation', *Management Learning*, 35(4), pp. 371-380.
- Easterby-Smith, M., Snell, R. and Gherardi, S. (1998) 'Organizational learning: Diverging communities of practice?' *Management Learning*, 29(3), pp. 259-272.
- Eccles, R.G. (1981) 'Bureaucratic versus craft administration: The relationship of market structure to the construction firm', *Administrative Science Quarterly*, 26(3), pp. 449-469.
- Economist (2005) *Overdue and Over Budget, Over and Over Again*, 375(8430), pp. 57-58.

- Edum-Fotwe, F., Price, A. and Thorpe, A. (1996) 'A review of financial ratio tools for predicting contractor insolvency', *Construction Management and Economics*, 14(3), pp. 189-198.
- Eisenhardt, K. (1989) 'Building theories from case study research', *Academy of Management Review*, 14(4), pp. 532-550.
- Epple, D., Argote, L. and Devadas, R. (1991) 'Organisational learning curves: A method for investigation intra-plant transfer of knowledge acquired through learning by doing', *Organization Science*, 2(1), pp. 58-70.
- Finnie, W. (1997) 'Strategies, systems, and organizations: An interview with Russell L. Ackoff', *Strategy and Leadership*, 25(2), pp. 22-26.
- Fiol, C.M. and Lyles, M.A. (1985) 'Organizational learning', *Academy of Management Review*, 10(4), pp. 803-813.
- Fong, P.S.W. and Yip, J.C.H. (2005) 'An investigative study of the application of lessons learned systems in construction projects', *Journal for Education in the Built Environment*, 1(2), pp. 27-38.
- Fortune, C. (2006) 'Process standardisation and the impact of professional judgment on the formulation of building project budget price advice', *Construction Management and Economics*, 24(10), pp. 1091-1098.
- Franco, L.A., Cushman, M. and Rosenhead, J. (2004) 'Project review and learning in the construction industry: embedding a problem structuring method within a partnership context', *European Journal of Operational Research*, 152, pp. 586-601.
- Fulmer, R. M. & Keys, B. (1998) 'A conversation with Chris Argyris: The father of organizational learning', *Organizational Dynamics*, 27(2), pp. 21-32.
- Garnett, N. and Pickrell, S. (2000) 'Benchmarking for construction: Theory and practice', *Construction Management and Economics*, 18, pp. 55-63.
- Garvin, D.A. (1993) 'Building a learning organization', *Harvard Business Review*, 71(4), pp. 78-91.
- Gherardi, S., Nicolini, D. (2000) 'Organizational learning of safety in communities of practice', *Journal of Management Inquiry*, 9(1), pp. 7-18.
- Goh, M. (2000) 'Quality circles: Journey of an Asian public enterprise', *International Journal of Quality & Reliability Management*, 17(7), pp. 784-799.
- Goh, S.C. (1998) 'Toward a learning organization: the strategic building blocks', *SAM Advanced Management Journal*, 63(2), pp. 15-22.
- Goh, S.C. (2002) 'Managing effective knowledge transfer: An integrative framework and some practice implications', *Journal of Knowledge Management*, 6(1), pp. 23-30.
- Goh, S.C. and Richards, G. (1997) 'Benchmarking the learning capability of organizations', *European Management Journal*, 15(5), pp. 575-588.
- Gorelick, C. (2005) 'Organisational learning vs the learning organisation: A conversation with a practitioner', *The Learning Organization*, 12(4), pp. 383-388.

- Grant, R. M. (1996) 'Toward a knowledge-based theory of the firm', *Strategic Management Journal*, 17(Winter), pp. 109-122.
- Gray, B. (2004) 'Informal learning in an online community of practice', *Journal of Distance Education*, 19(1), pp. 20-35.
- Groák, S. (1994) 'Is construction an industry? Notes towards a greater analytic emphasis on external linkages', *Construction Management and Economics*, 12, pp. 287-293.
- Gunasekara, C. (2003) 'Project-based workplace learning: A case study', *SAM Advanced Management Journal*, 68(1), pp. 37-49.
- Hansen, M., Nohria, N. and Tierney, T. (1999) 'What's your strategy for managing knowledge?', *Harvard Business Review*, March-April, pp. 106-16.
- Hanseth, O., Monteiro, E. and Hatling, M. (1996) 'Developing information infrastructure: The tension between standardisation and flexibility', *Science, Technology, and Human Values*, 21(4), pp. 407-426.
- Harrison, J. and Boyle, E. (2006) 'Falling into capability learning traps: The role of the firm's predominant managerial mental models', *Management Decision*, 44(1), pp. 31-43.
- Harvey, M., Palmer, J. and Speier, C. (1998) 'Implementing intra-organizational learning: A phased-model approach supported by intranet technology', *European Management Journal*, 16(3), pp. 341-354.
- Haskins, W.A. (1997) 'Freedom of speech: Construct for creating a culture which empowers organizational members', *The Journal of Business Communication*, 33(1), pp. 85-97.
- Hawkins, P. (1994) 'Organizational learning: Taking stock and facing the challenge', *Management Learning*, 25(3), pp. 433-461.
- Hayden Jr, W.M. (2006) 'Human Systems Engineering – A trilogy, Part II: May the force be with you (Anatomy of project failures)', *Leadership & Management in Engineering*, 6(1), pp. 1-12.
- Hayden Jr., W. M. (2004) 'Human Systems Engineering – A trilogy, Part I: Elephant in the Living Room', *Leadership & Management in Engineering*, 4(2), pp. 61-71.
- He, Z.L. And Wong, P.K. (2004) 'Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis', *Organization Science*, 15(4), pp. 481-494.
- Herriott, S., Levintal, D. and March, J. (1985) 'Learning from experience in organizations', *American Economic Review*, 75, pp. 298-302.
- Hew, K.F. and Hara, N. (2006) 'Identifying factors that encourage and hinder knowledge sharing in a longstanding online community of practice', *Journal of Interactive Online Learning*, 5(3), pp. 291-315.
- Hill, F.M. (1996a) 'Organizational learning for TQM through quality circles', *The TQM Magazine*, 8(6), pp. 53-57.
- Hill, F.M. (1997) 'En route to TQM: Organizational learning through quality circles', *Training for Quality*, 5(2), pp. 84-87.

- Hill, R. (1996b) 'A measure of the learning organization', *Industrial and Commercial Training*, 28(1), pp. 19-25.
- Huber, G.P. (1991) 'Organizational learning: the contributing processes and the literatures', *Organization Science*, 2, pp. 88-115.
- Hurley, R.F. (2002) 'Putting people back into organisational learning', *Journal of Business & Industrial Marketing*, 17(4), pp. 270-281.
- Hurley, R.F. and Hult, G.T.M. (1998) 'Innovation, market orientation, and organizational learning: an integration and empirical examination', *Journal of Marketing*, 62, pp. 42-54.
- Husin, R. and Rafi, A. (2003) 'The impact of internet-enabled computer-aided design in the construction industry', *Automation in Construction*, 12(5), pp. 509-513.
- Isaacs, W. (1993) 'Taking flight: Dialogue, collective thinking, and organizational learning', *Organizational Dynamics*, 22(2), pp. 24-39.
- Jacko, J.A., Salvendy, G. and Sainfort, F. (2002) 'Intranets and organizational learning: A research and development agenda', *International Journal of Human-Computer Interaction*, 14 (1), pp. 93-130.
- James, K. (1999) 'Re-thinking organisational stress: The Transition to the new employment age', *Journal of Managerial Psychology*, 14(7/8), pp. 545-557.
- Jashapara, A. (1993) 'The competitive learning organization: A quest for the holy grail', *Management Decision*, 31(8), pp. 52-62.
- Ji, Y.G. and Dalvendy, G. (2004) 'Interface methods for using intranet portal organizational learning memory information system', *Ergonomics*, 47(15), pp. 1585-1597.
- Johannessen, J. and Hauan, A. (1994) 'Organizational unlearning', *Creativity and Innovation Management*, 3(1), pp. 43-53.
- Jordan, J. and Jones, P. (1997) 'Assessing your company's knowledge management style', *Long Range Planning*, 30(3), pp. 392-398.
- Kärnä, S. (2004) 'Analysing customer satisfaction and quality in construction: the case of public and private customers', *Nordic Journal of Surveying and Real Estate Research, Special Series*, 2, pp. 67-80.
- Kartam, N.A. (1996) 'Making effective use of construction lessons learned in project life cycle', *Journal of Construction Engineering and Management*, 122(1), pp. 14-21.
- Karvinen, K. and Bennett, D. (2006) 'Enhancing performance through the introduction of customer orientation into the building components industry', *International Journal of Productivity and Performance*, 55(5), pp. 400-422.
- Katz, D. (1964) 'The motivational basis of organisational behaviour', *Behavioral Science*, 9, pp. 131-146.
- Kaye, B. and Jacobson, B. (1999) 'True tales and tall tales: The power of organizational storytelling', *Training and Development*, 53(3), pp. 44-52.

- Kessler, E.H., Bierly, P.E. and Gopalakrishnan, S. (2000) 'Internal vs. external learning in new product development: Effects on speed, costs and competitive advantage', *R&D Management*, 30(3), pp. 213-223.
- Khadra, M.F.F. and Rawabdeh, I.A. (2006) 'Assessment of development of the learning organization concept in Jordanian industrial companies', *The Learning Organization*, 13(5), pp. 456-474.
- Khalfan, M.A., Anumba, C.J. and Carrillo, P.M. (2001) 'Development of a readiness assessment model for concurrent engineering in construction', *Benchmarking: An International Journal*, 8(3), pp. 223-239.
- Kiewra, K.A., DuBois, N.F., Christian, D. and McShane, A. (1988) 'Providing study notes: Comparison of three types of notes for review', *Journal of Educational Psychology*, 80, pp. 595-597.
- Kiewra, K.A., DuBois, N.F., Christian, D., McShane, A., Meyer-Hoffer, M. and Roskelley, D. (1991) 'Note-taking functions and techniques', *Journal of Educational Psychology*, 83, pp. 240-245.
- Killing, P. (1980) 'Technology acquisition: Licencing agreements or joint venture', *Columbia Journal of World Business*, 15(3), pp. 38-46.
- Kim, D.H. (1993) 'The link between individual and organizational learning', *Sloan Management Review*, Fall, pp. 37-50.
- Kimoto, K., Eno, K., Iwashita, S. and Fujiwara, M. (2005) 'The application of PDA as mobile computing system on construction management', *Automation in Construction*, 14(4), pp. 500-511.
- Knipstein, S.C. (2007) 'Communicating to employees when they're not really your employees', *Public Relations Tactics*, 14(3), pp. 21.
- Koch, C. (2004) 'The tyranny of projects: Teamworking, knowledge production and management in consulting engineering', *Economic and Industrial Democracy*, 25(2), pp. 277-300.
- Kogut, B. and Zander, U. (1992) 'Knowledge of the firm, combinative capabilities, and the replication of technology', *Organization Science*, 3(3), pp. 383-397.
- Kotnour, T. (2000) 'Organizational learning practices in the project management environment', *International Journal of Quality & Reliability Management*, 17(4/5), pp. 393-406.
- Kriegesmann, B., Kley, T. and Schwering, M.G. (2007) 'Making organizational learning happen: the value of creative failures', *Business Strategy Series*, 8(4), pp. 270-276.
- Krippendorff, K. (1975) 'Some principles of information storage and retrieval in society', *General Systems*, 20, pp. 15-35.
- Krizek, R.J. and Hadavi, A. (1996) 'Lessons learned from multiphase reconstruction project', *Journal of Construction Engineering and Management*, 122(1), pp. 44-54.
- Kululanga, G K, Price, A D F and McCaffer, R (2002) 'Empirical investigation of construction contractors' organizational learning', *Journal of Construction Engineering and Management*, 128(5), pp. 385-391.

- Kululanga, G.K., Edum-Fotwe, F.T. and McCaffer, R. (2001) 'Measuring construction contractors' organizational learning', *Building Research & Information*, 29(1), pp. 21-29.
- Laiken, M. (2003) 'Models of organizational learning: Paradoxes and best practices in the post industrial workplace', *Organization Development Journal*, 21(1), pp. 8.
- Laise, D. (2004) 'Benchmarking and learning organisations: Ranking methods to identify 'best in class'', *Benchmarking: An international Journal*, 11(6), pp. 621-630.
- Langford, D., Iyagba, R. and Komba, D.M. (1993) 'Prediction of solvency in construction companies', *Construction Management and Economics*, 11(5), pp. 317-325.
- Lant, T.K., Milliken, F.J. and Batra, B. (1992) 'The role of managerial learning and interpretation in strategic persistence and reorientation', *Strategic Management Journal*, 13, pp. 585-608.
- Leonard-Barton, D. (1992) 'The factory as a learning laboratory', *Sloan Management Review*, Fall, pp. 23-38.
- Leseure, M.J. and Brookes, N.J. (2004) 'Knowledge management benchmarks for project management', *Journal of Knowledge Management*, 8(1), pp. 103-116.
- Levintal, D.A. and March, J.G. (1993) 'The myopia of learning', *Strategic Management Journal*, 14, pp. 95-112.
- Levitt, B. and March, J. G. (1988) 'Organizational learning', *Annual Review of Sociology*, 14, pp. 319-340.
- Liebowitz, J. (1999) 'Key ingredients to the success of an organization's knowledge management strategy', *Knowledge and Process Management*, 6(1), pp. 37-40.
- Liebowitz, J. (2001) 'Knowledge management and its link to artificial intelligence', *Expert Systems with Applications*, 20(1), pp. 1-6.
- Liebowitz, J. and Megbolugbe, I. (2003) 'A set of frameworks to aid the project manager in conceptualizing and implementing knowledge management initiatives', *International Journal of Project Management*, 21, pp. 189-98.
- Lin, Y., Wang, L. and Tserng, H. (2006) 'Enhancing knowledge exchange through web map-based knowledge management system in construction: Lessons learned in Taiwan', *Automation in Construction*, 15(6), pp. 693-705.
- Lipshitz, R., Popper, M. and Friedman, V.J. (2002) 'A multi-facet model of organizational learning', *The Journal of Applied Behavioral Science*, 38(1), pp. 78-98.
- Liu, W. (2006) 'Knowledge exploitation, knowledge exploration, and competency trap', *Knowledge and Process Management*, 13(3), pp. 141-161.
- Loo, A.W. (2003) 'The future of peer-to-peer computing', *Communications of the ACM*, 46(9), pp. 56-61.
- Love, P.E.D., Edwards, D.J. and Irani, Z. (2004) 'Nurturing a learning organization in construction: A focus on strategic shift, organizational transformation, customer orientation and quality centered learning', *Construction Innovation*, 4, pp. 113-126.

- Love, P.E.D., Li, H., Irani, Z. and Faniran, O. (2000) 'Total quality management and the learning organization: a dialogue for change in construction', *Construction Management and Economics*, 18(3), pp. 321-331.
- Love, P.E.D., Li, H., Irani, Z., Holt, G.D. (2000) 'Total quality management: a framework for facilitating organisational learning and change in construction', *The International Bi-Monthly for Total Quality Management: TQM Magazine*, 12(2), pp. 107-117.
- Luthans, F. (1995) 'Going beyond total quality: the characteristics, techniques, and measure of learning organizations', *The International Journal of Organizational Analysis*, 3(1), pp. 24-44.
- Lynn, G.S., Skov, R.B. and Abel, K.D. (1999) 'Practices that support team learning and their speed to market and new product success', *The Journal of Product Innovation Management*, 16(5), pp. 439-454.
- Mahler, J. (1997) 'Influences of organizational culture on learning in public agencies', *Journal of Public Administration Research & Theory (Transaction)*, 7(4), pp. 519-541.
- Maqsood, T. Finegan, A. and Walker, D. (2006) 'Applying project histories and project learning through knowledge management in an Australian construction industry', *The Learning Organization*, 13(1), pp. 80-96.
- March, J.G. (1991) 'Exploration and exploitation in organizational learning', *Organization Science*, 2(1), pp. 71-87.
- March, J.G. and Olsen, J.P. (1975) 'Organizational learning under ambiguity', *European Journal of Policy Review*, 3(2), pp. 147-71.
- March, J.G., Sproull, L.S. and Tamuz, M. (1991) 'Learning from samples of one or fewer', *Organization Science*, 2(1), pp. 1-13.
- March, J.G. and Simon, H.A. (1993) 'Organizations revisited', *Industrial and Corporate Change*, 2(2), pp. 229-316.
- Marcus, A.A. and Nichols, M.L. (1999) 'On the edge: Heeding the warnings of unusual events', *Organization Science*, 10(4), pp. 482-500.
- Marks, A. and Lockyer, C. (2004) 'Producing knowledge: The use of the project team as a vehicle for knowledge and skill acquisition for software employees', *Economic and Industrial Democracy*, 25(2), pp. 219-245.
- Markus, M.L. (2001) 'Toward a theory of knowledge reuse: Types of knowledge reuse situations and factors in reuse success', *Journal of Management Information System*, 18(1), pp. 57-93.
- Massey, C. and Walker, R. (1999) 'Aiming for organizational learning: Consultants as agents for change', *The Learning Organization*, 5(1), pp. 38-44.
- Matzdorf, F. and Price, I. (2000) 'Barriers to organizational learning in the chartered surveying profession', *Property Management*, 18(2), pp. 92-113.
- McDermott, R. (1999) 'Why information technology inspired but cannot deliver knowledge management', *California Management Review*, 41(4), pp. 103-117.
- McInerney, C. (2002) 'Knowledge management and the dynamic nature of knowledge', *Journal of the American Society for Information Science and technology*, 53(12), pp. 1009-1018.

- Meggison, D. (1996) 'Planned and emergent learning: consequences for development', *Management Learning*, 27(4), pp. 411-28.
- Merono-Cerdan, A.L., Lopez-Nicolas, C. and Sabater-Sanchez, R. (2007) 'Knowledge management strategy diagnosis from KM instruments use', *Journal of Knowledge Management*, 11(2), pp. 60-72.
- Mikkelsen, A., Saksvik, P.O. and Ursin, H. (1998) 'Job stress and organizational learning climate', *International Journal of Stress Management*, 5(4), pp. 197-209.
- Miller, D. (1996) 'A preliminary typology of organisational learning: synthesizing the literature', *Journal of Management*, 22(3), pp. 485-505.
- Miller, D. and Chen, M. (1994) 'Sources and consequences of competitive inertia: A study of the U.S. Airline Industry', *Administrative Science Quarterly*, 39, pp. 1-23.
- Miner, A. (1991) 'Organizational evolution and the social ecology of jobs', *American Sociological Review*, 56, pp. 772-785.
- Miner, A. S., Kim, J. Y., Holzinger, I. W. and Haunschild, P. (1999) 'Fruits of failure: Organizational failure and population-level learning', *Advances in Strategic Management*, 16, 187-220.
- Mitchell, R and Nicholas, S (2006) 'Knowledge creation in groups: The value of cognitive diversity, transactive memory, and open-mindedness norms', *The Electronic Journal of Knowledge Management*, 4(1), pp. 67-74.
- Mitki, Y., Shani, A.B. and Meiri, Z. (1997) 'Organisational learning mechanisms and continuous improvement: A longitudinal study', *Journal of Organizational Change Management*, 10(5), pp. 426-446.
- Modell, S. (2005) 'Triangulation between case study and survey methods in management accounting research: An assessment of validity implications', *Management Accounting Research*, 16(2), pp. 231-254.
- Monaghan, A. and Lane, T. (2007) 'Capacity fears grow as industry boom continues', *Building*, 4 May.
- Montes, F.J.L., Moreno, A.R. and Fernandez, L.M.M. (2004) 'Assessing the organizational climate and contractual relationship for perceptions of support for innovation', *International Journal of Manpower*, 25(2), pp. 167-180.
- Montuori, L.A. (2000) 'Organizational longevity: Integrating systems thinking, learning and conceptual complexity', *Journal of Organizational Change Management*, 13(1), pp. 61-73.
- Morris, M., Bessant, J. and Barnes, J. (2006) 'Using learning networks to enable industrial development', *International Journal of Operations & Production Management*, 26(5), pp. 532-557.
- Morrison, E.W. and Milliken, F.J. (2000) 'Organizational silence: A barrier to change and development in a pluralistic world', *Academy of Management Journal*, 25(4), pp. 706-725.
- Mulholland, P. Zdrahal, Z., Domingue, J. and Hatala, M. (2000) 'Integrating working and learning: A document enrichment approach', *Information Technology and Learning*, 19(3), pp. 171-180.

- Mulholland, P., Zdrahal, Z. and Dominique, J. (2005) 'Supporting continuous learning in a large organization: The role of group and organizational perspectives', *Applied Ergonomics*, 36, pp. 127-134.
- Mulholland, P., Zdrahal, Z., Dominique, J. and Hatala, M. (2001) 'A methodological approach to supporting organizational learning', *International Journal of Human-Computer Studies*, 55(3), pp. 337-367.
- Nesan, L.J. (2004) 'Efficacy-information for implementing learning in construction', *The Learning Organization*, 11(1), pp. 45-66.
- Nevis, E.C., DiBella, A.J. and Gould, J.M. (1995) 'Understanding organizations as learning systems', *Sloan Management Review*, 36(2), pp. 73-85.
- Ngowi, A. (ed.) (2002) 'Editorial: Challenges facing construction industries in developing countries', *Building Research & Information*, 30(3), pp. 149-151.
- Ngulube, P. (2001) 'Guidelines and standards for records management education and training: A model for Anglophone Africa', *Records Management Journal*, 11(3), pp. 155-173.
- Nguyen, L.D., Ogunlana, S.O. and Lan, D.T.X. (2004) 'A study on project success factors in large construction projects in Vietnam', *Engineering, Construction and Architectural Management*, 11(6), pp. 404-414.
- Nicholls-Nixon, C.L., Cooper, A.C. and Woo, C.Y. (2000) 'Strategic experimentation: Understanding change and performance in new ventures', *Journal of Business Venturing*, 15(5/6), pp. 493-521.
- Nishgaki, S. (1994) 'Humanware, human error and Hiyari-hat: A template of unsafe symptoms', *Journal of Construction Engineering and Management*, 120(2), pp. 421-441.
- Nonaka, I. (1991) 'The knowledge creating company', *Harvard Business Review*, November/December, pp. 96-104.
- Nonaka, I. (1994) 'A dynamic theory of organizational knowledge creation', *Organization Science*, 5 (1), 14-37.
- North, K. (1997) 'Localising global production know-how transfer in manufacturing', *Management Development Series*, 33, pp. 61-65. Geneva: International Labour Organization.
- Nyhan, B., Cressey, P., Tomassini, M., Kelleher, M. and Poell, R. (2004) 'European perspectives on the learning organization', *Journal of European Industrial Training*, 28(1), pp. 67-92.
- O'Dell, C., and Grayson, C. (1998) 'If only we knew what we know: Identification and transfer of internal best practices', *California Management Review*, 40(3), pp. 154-174.
- Olivera, F. (2000) 'Memory systems in organizations: An empirical investigation of mechanisms for knowledge collection, storage and access', *Journal of Management Studies*, 37(6), pp. 811-832.
- Orlikowski, W. (1992) 'The duality of technology: Rethinking the concept of technology in organizations', *Organization Science*, 3(3), pp. 398-427.
- Ortega, I. (2000) 'Systematic prevention of construction failures: An overview', *Technology, Law and Insurance*, 5(1/2), pp. 15-22.

- Örtenblad, A. (2001) 'On differences between organisational learning and learning organization', *The Learning Organization*, 8(3), pp. 125-133.
- Örtenblad, A. (2005) 'Of course organizations can learn!', *The Learning Organization*, 12(2), pp. 213-218.
- Ozorhon, B. Dikmen, I. and Birgonul, M.T. (2005) 'Organizational memory formation and its use in construction', *Building Research & Information*, 33(1), pp. 67-79.
- Pascale, R.T. (1984) 'Perspectives on strategy: The real story behind Honda's success', *California Management Review*, 16(3), pp. 47-73.
- Pham, N.T. and Swierczek, F.W. (2006) 'Facilitators of organizational learning in design', *The Learning Organization*, 13(2), pp. 186-201.
- Pheng, L.S. and Ke-Wei, P. (1996) 'A framework for implementing TQM in construction', *The TQM Magazine*, 8(5), pp. 39-46.
- Phillips, B.T. (2004) 'A four-level learning organization benchmark implementation model', *The Learning Organization*, 10(2), pp. 98-105.
- Popper, M. and Lipshitz, R. (2000) 'Organizational learning: mechanisms, culture, and feasibility', *Management Learning*, 31(2), pp. 181-196.
- Poulton, M.S. (2005) 'Organizational storytelling, ethics and morality: How stories frame limits of behaviour in organizations', *Electronic Journal of Business Ethics and Organizational Studies*, 10(2), pp. 4-9.
- Prencipe, A. and Tell, F. (2001) 'Inter-project learning: processes and outcomes of knowledge codification in project-based firms', *Research Policy*, 30, pp. 1373-1394.
- Rae, D. (2005) 'Entrepreneurial learning: A narrative-based conceptual model', *Journal of Small Business and Enterprise Development*, 12(3), pp. 323-335.
- Raftery, J., McGeorge, D. and Walters, M. (1997) 'Breaking up methodological monopolies: A multi-paradigm approach to construction management research', *Construction Management and Economics*, 15(3), pp. 291-297.
- Randal, G.K. and Martin, P. (2003) 'Developing and using stories or narratives to transmit values and legacy', *Organization Development Journal*, 21(3), pp. 44-50.
- Redding, J. (1997) 'Hardwiring the learning organization', *Training and Development*, 51(8), pp. 61-7.
- Reynolds, R. and Ablett, A. (1998) 'Transforming the rhetoric of organisational learning to the reality of the learning organisation', *The Learning Organization*, 5(1), pp. 24-35.
- Riis, J.O., Luxhoj, J.T. and Thorsteinsson, U. (1997) 'A situational maintenance model', *International Journal of Quality & Reliability Management*, 14(4), pp. 349-366.
- Robertson, J. (2004) 'Intranets and knowledge sharing', *KM Column*, May, pp. 1-6.
- Robinson, H.S., Anumba, C.J. and Carrillo, P.M. (2005) 'Business performance measurement practices in construction engineering organisations', *Measuring Business Excellence*, 9(1), pp. 13-22.

- Robinson, T., Clemson, B. and Keating, C. (1997) 'Development of high performance organizational learning units', *The Learning Organization*, 4(5), pp. 228-234.
- Robinson, V.M.J. (2001) 'Descriptive and normative research on organizational learning: locating the contribution by Argyris and Schön', *The International Journal of Education Management*, 15(2), pp. 58-67.
- Romme, G. and Dillen, R. (1997) 'Mapping the landscape of organizational learning', *European Management Journal*, 15(1), pp. 68-78.
- Ron, N., Lipshitz, R. and Popper, M. (2006) 'How organizations learn: Port-flight reviews in an F-16 fighter squadron', *Organization Studies*, 27(8), pp. 1069-1089.
- Rosenfield, Y., Warszawski, A. and Laufer, A. (1992) 'Using quality circles to raise productivity and quality of work life', *Journal of Construction Engineering and Management*, 118(1), pp. 17-33.
- Rossman, E.P. (1967) 'Standardization of specifications', *Heating, Piping and Air Conditioning*, June, pp. 133-136.
- Roth, G. and Kleiner, A. (1998) 'Developing organizational memory through learning histories', *Organizational Dynamics*, 27(2), pp. 43-59.
- Rowden, R.W. (2001) 'The learning organization and change', *SAM Advanced Management Journal*, 66(3), pp. 11-20.
- Rowley, J. and Slack, F. (2004) 'Conducting a literature review', *Management Research News*, 27(6), pp. 31-39.
- Ruggles, R. (2002) 'The role of stories in knowledge management', *Journal of Storytelling and Business Excellence*. Available at: www.storytellingcenter.com/articles.html
- Salojarvi, S., Furu, P. and Sveiby, K. (2005) 'Knowledge management and growth in Finish SMEs', *Journal of Knowledge Management*, 9(2), pp. 103-122.
- Santos, A., Powell, J.A. and Hinks, J. (2001) 'Using pattern matching for the international benchmarking of production practices', *Benchmarking: An International Journal*, 8(1), pp. 35-47.
- Schaafsma, H. (1997) 'Alternative pathways to management competence: Housing construction', *Journal of European Industrial Training*, 21(1), pp. 19-25.
- Schmiemann, M. (2006) 'SMEs and entrepreneurship in the EU', *Statistics in Focus: Industry, Trade and Services*, 24, pp. 1-7.
- Senge, P.M. (2003) 'Taking personal change seriously: The impact of Organizational Learning on management practice', *Academy Management Executive*, 17(2), pp. 47-50.
- Shaw, R.B. and Perkins, D.N.T. (1991) 'Teaching organizations to learn', *Organization Development Journal*, 9, pp. 1-12.
- Shirong, L. (2001) 'China's construction education in higher transition', *Building Research & Information*, 29(4), pp. 302-311.
- Shohet, I.M. and Frydman, S. (2003) 'Communication patterns in construction at construction manager level', *Journal of Construction Engineering and Management*, 129(5), pp. 570-577.

- Shohet, I.M. and Laufer, A. (1991) 'What does the construction foreman do?', *Construction Management and Economics*, 9, pp. 565-576.
- Shrivastava, P. (1983) 'A typology of organizational learning systems', *Journal of Management Studies*, 20(1), pp. 7-28.
- Simon, H. A. (1991) 'Bounded rationality and organizational learning', *Organization Science*, 2, pp. 125-134.
- Sinkula, J. M. and Baker, J.M. (1997) 'A Framework for Market-Based Organizational Learning: Linking Values, Knowledge, and Behavior', *Journal of the Academy of Marketing Science*, 25(4), pp. 305-318.
- Sitkin, S.B. (1992) 'Learning through failure: The strategy of small losses', *Research in Organizational Behavior*, 14, pp. 231-266.
- Sitkin, S.B., Sutcliffe, K.M., and Schroder, R.G. (1994) 'Distinguishing control form learning in total quality management: A contingency perspective', *Academy of Management Review*, 19, pp. 537-564.
- Skandalakis, A. and Nelder, G. (2001) 'Benchmarking as a diagnostic process to increase the competitiveness of small and medium-sized manufacturing enterprises', *International Journal of Business Performance Management*, 3(2/3), pp. 261-275.
- Slater, S.F. and Narver, J.C. (1995) 'Market orientation and the learning organization', *Journal of Marketing*, 59(3), pp. 63-74.
- Snider, K.F., Barrett, F.J. and Tenkasi, R. (2002) 'Considerations in acquisition lessons-learned system design', *Acquisition Review Quarterly*, Winter, pp. 67-84.
- Snowden, D.J. (1999) 'Story telling: an old skill in a new context', *Business Information Review*, 16(1), pp. 30-37.
- Snowden, D.J. (2000a) 'The art and science of story or 'are you sitting uncomfortably?': Part 1, Gathering and harvesting the raw material', *Business Information Review*, 17(3), pp. 147-156.
- Snowden, D.J. (2000b) 'The art and science of story or 'are you sitting uncomfortably?': Part 2, The weft and the warp of purposeful story', *Business Information Review*, 17(4), pp. 215-226.
- Snyder, W. and Cummings, A. (1998) 'Organisation learning disorders: Conceptual model and intervention hypotheses', *Human Relations*, 51(7), pp. 873-895.
- Sole, D. and Edmondson, A. (2002) 'Situated knowledge and learning in dispersed teams', *British Journal of Management*, 13(s2), pp. S17-S34.
- Song, L., Mohamed, Y. and AbouRizk, S.M. (2006) 'Evaluating contractor's early involvement in design', *AACE International Transactions*, PM.S06, pp. 1-8.
- Spender, J.-C. (1994) 'Organizational knowledge, collective practice, and Penrose rents', *International Business Review*, 3(4), 353-367.
- Staub-French, S. and Khanzode, A. (2007) '3D and 4D modelling for design and construction coordination: Issues and lessons learned', *Journal of Information Technology in Construction*, 12, 381-407.

- Stein, E.W. (1992) 'A method to identify candidates for knowledge acquisition', *Journal of Management Information Systems*, 9(2), pp. 161-178.
- Stein, E.W. (1995) 'Organizational Memory: Review of Concepts and Recommendations for Management', *International Journal of Information Management*, 15(1), pp. 17- 31.
- Stewart, R.A. and Mohamed, S. (2004) 'Evaluating web-based project information management in construction: Capturing the long-term value creation process', *Automation in Construction*, 13(4), pp. 469-479.
- Stinchcombe, A. (1959) 'Bureaucratic and craft administration of production: A comparative study', *Administrative Science Quarterly*, 4, pp. 168-187.
- Styhre, A, Josephson, P and Knauseder, I (2004) 'Learning capabilities in organizational networks: case studies of six construction projects', *Construction Management & Economic*, 22(9), pp. 957-966.
- Sullivan, M.J. and Scattolon, Y. (1995) 'Health policy planning: A look at consumer involvement in Nova Scotia', *Canadian Journal of Public Health*, 86, pp. 317-320.
- Sun, C. (2003) 'Conceptual clarifications for organizational learning, learning organization and a learning organization', *Human Resources Development International*, 6(2), pp. 153-166.
- Sun, P.Y.T. and Scott, J.L. (2003) Exploring the divide – organizational learning and learning organization, *The Learning Organization*, 10(4), pp.202-215.
- Sveiby, K. (2001) 'A knowledge-base theory of the firm to guide in strategy formulation', *Journal of Intellectual Capital*, 2(4), pp. 344-58.
- Symon, G. (2002) 'The reality of rhetoric and the learning organization in the UK', *Human Resources Development International*, 5(2), pp. 155-174.
- Teare, R. (1997) 'Enabling organizational learning', *International Journal of Contemporary Hospitality Management*, 9(7), pp. 315-324.
- Thomas, R. (2001) 'Business value analysis: Coping with unruly uncertainty', *Strategy and Leadership*, 29(2), pp. 16-23.
- Trafton, J.G. and Trickett, S.B. (2001) 'Note-taking for self-explanation and problem solving', *Human-Computer Interaction*, 16, pp. 1-38.
- Tsai, W. (2002) 'Social Structure of "Coopetion" Within a Multiunit Organization: Coordination, Competition, and Intraorganizational Knowledge Sharing', *Organization Science*, 13(2), 179-190.
- Tsang, E.W.K (1997) 'Organizational learning and the learning organization: a dichotomy between descriptive and prescriptive research', *Human Relations*, 50(1), pp. 73-89.
- Tserng, H.P. and Lin, Y. (2004) 'Developing an activity-based knowledge management system for contractors', *Automation in Construction*, 13(6), pp. 781-802.
- Tuler, S. (1998) 'Learning through participation', *Human Ecology Review*, 5(1), pp. 58-60.
- Tushman, M.L. and O'Reilly, C.A. (1996) 'Ambidextrous organizations: Managing evolutionary and revolutionary change', *California Management Review*, 38(4), pp. 8-30.

- Vakola, M. and Rezgui, Y. (2000) 'Organisational learning and innovation in the construction industry', *The Learning Organization*, 7(4), pp. 174-183.
- Vestal, K. (2004) 'Fostering a spirit of innovation', *Nurse Leader*, 2(3), pp. 6-7.
- Von Zedtwitz, M. (2002) 'Organizational learning through post-project reviews in R&D', *R&D Management*, 32(3), pp. 255-268.
- Walsh, J.P. and Ungson, G.R. (1991) 'Organizational memory', *Academy of Management Review*, 16, pp. 57-91.
- Wang, G. and Yang, J. (2000) 'Business development strategy and Australian construction industry', *International Journal for Construction Marketing*, 2 (1), pp. 1-10.
- Wardhana, K. and Hadipriono, F.C. (2003) 'Study of recent building failures in the United States', *Journal of Performance Constructed Facilities*, 17(3), pp. 151-158.
- Watkins, K.E. and Golembiewski, T. (1995) 'Rethinking organization development for the learning organisation', *The International Journal of Organizational Analysis*, 3(1), pp. 86-101.
- Weerawardena, J. (2003) 'Exploring the role of market learning capability in competitive strategy', *European Journal of Marketing*, 37(3/4), pp. 407-429.
- Weerawardena, J., O'Cass, A. and Julian, C. (2006) 'Does industry matter? Examining the role of industry structure and organizational learning in innovation and brand performance', *Journal of Business Research*, 59(1), pp. 37-45.
- Weick, K.E. (1991) 'The non traditional quality of organisational learning', *Organization Science*, 2 pp. 116-124.
- Wenger, E. and Snyder, W.M. (2000) 'Communities of practice: The organizational frontier', *Harvard Business Review*, 78(1), pp. 139-145.
- Wijnhoven, F. (1998) 'Designing organizational memories: Concept and Methods', *Journal of Organizational Computing and Electronic Commerce*, 8(1), pp. 29-55.
- Wilkinson, A. and Mellahi, K. (2005) 'Organizational failure', *Long Range Planning*, 28(3), pp. 233-238.
- Williamson, M., Wilson, O., Skitmore, M. and Runeson, G. (2004) 'Client abuses of the competitive tendering system: Some general principles and case study', *Journal of Construction Research*, 5(1), pp. 61-73.
- Wing, C.K., Raftery, J. and Walker, A. (1998) 'The baby and the bathwater: Research methods in construction management', *Construction Management and Economics*, 16(1), pp. 99-104.
- Winter, S. (2000) 'The satisfying principle in capability learning', *Strategic Management Journal*, 21, pp. 981-996.
- Wirth, M.A. (2003) 'E-notes: using electronic lecture notes to support active learning in computer science', *ACM SICCSSE Bulletin*, 35(2), pp. 57-60.
- Worrell, D. (1995) 'The learning organization: Management theory for the information age or new age fad?', *Journal of Academic Librarianship*, 21(5), pp. 351-357.

- Yates, J.K. and Lockley, E.E. (2002) 'Documenting and analyzing construction failures', *Journal of Construction Engineering and Management*, 128(1), pp. 8-17.
- Yee, C.Y. and Cheah, C.Y.J. (2006) 'Fundamental Analysis of profitability of large engineering and construction firms', *Journal of Management in Engineering*, 22(4), pp. 203-210.
- Yeo, R.K. (2006) 'Implementing organizational learning initiatives: Integrating three levels of learning', *Development and Learning in Organizations*, 20(3), pp. 10-12.
- Zack, M. (1999) 'Developing a knowledge strategy', *California Management Review*, 41(3), pp. 125-145.
- Zarraga, C. and Garcia-Falcon, J.M. (2003) 'Factors favoring knowledge management in work teams', *Journal of Knowledge Management*, 7(2), pp. 81-96.
- Zetie, S. (2002) 'The quality circle approach to knowledge management', *Managerial Auditing Journal*, 17(6), pp. 317-321.
- Zhiliang, M., Heng, L., Shen, Q.P. and Jun, Y. (2004) 'Using XML to support information exchange in construction projects', *Automation in Construction*, 13(5), pp. 629-637.
- Zollo, M. and S. G. Winter (2002) 'Deliberate learning and the evolution of dynamic capabilities', *Organization Science*, 13(3), pp. 339-353.

Research Reports

- CCIC (2007) *Measuring the performance of the Canadian Construction Industry: Pilot Project Final Report*. Canadian Construction Innovation Council.
- Davenport, D. and Smith, R. (1995) 'Assessing the effectiveness of client participation in construction projects', *COBRA: RICS Research Publication*. The Royal Institution of Chartered Surveyors.
- Davis Langdon and Seah International (2004) *World Construction Review/Outlook 2003/2004*. Available at: <http://www.davislangdon.com.au/> (Accessed: 7 October 2004).
- Gibb, A.G.F. (2001) 'Pre-assembly in construction', *CRISP Consultancy Commission Report*, 00/19, pp. 1-32.
- ILO (2001) *The Construction Industry in the Twenty-first Century: Its Image, Employment Prospects and Skill Requirements*. Geneva: International Labour Organization.
- Khan, F. (1993) *A Survey of Note-taking Practices*. HPL-93-107. Bristol: Hewlett-Packard Laboratories.
- Smits, M.T. and DeMoor, A.R.E.M. (2003) 'Effective knowledge management in project-based organizations', *Public Report published by METIS*, Tilburg University.
- Weber, R., Aha, D.W. and Becerra-Fernandez, I. (2000a) 'Categorizing intelligent lessons learned systems', in D.W. Aha and R. Weber (eds.) *Intelligent Lessons Learned Systems: Papers from the AAAI 2000 Workshop*. (Technical Report WS-00-008). Menlo Park, CA: AAAI Press, pp. 63-67.

Conference Papers

- Bresnen, M. and Swan, J. (2002) 'Understanding the Implementation of New Management Initiatives in Construction Firm', *Proceeding of the Eighteen Annual ARCOM Conference*. Northumbria University, 2-4 September. Newcastle upon Tyne, pp. 657-666.
- Chiu, P., Kapuskar, A., Reitmeier, S. and Wilcox, L. (1999) 'NoteLook: Taking notes in meetings with digital video and ink', *Proceedings of ACM Multimedia*. Orlando, FL: 30 October.
- Datta, M. (2000) 'Challenges facing the construction industry in developing countries', in *Proceedings of the 2nd International Conference on Construction in Developing Countries*. Gaborone 15-17 November, pp. 119-127.
- Egbu, C., Lee, C.C., Boyd, D., Xiao, H. and Chinyio, E. (2005) 'Graphical conveyance of knowledge amongst construction SMEs', *CIB W102 Conference Proceedings: Information and Knowledge Management in a Global Economy*. Lisboa, Portugal 19-20 May, pp. 475-485.
- Engelbart, D. (1984) 'Authorship provisions in Augment', *Proceedings of the IEEE Computer Society International Conference*. San Francisco, CA 27 February-1 March, pp. 465-472.
- Huysman, M., Leonard, D. and Nicolle, A. (2002) 'Towards a learning perspective on knowledge/technology transfer through corporate acquisitions', *Proceedings of the 35th Hawaii International Conference on System Sciences*, 8, pp. 3229-3238.
- Jewel, T., Underwood, A. and Heredero, C.P. (2003) 'The role of informal networks in knowledge sharing', *Proceedings of the 11th European Conference on Information Systems, ECIS 2003*. Naples, Italy 16-21 June.
- Newell, S., Scarborough, H., Swan, J. and Galliers, R. (2005) 'Sharing learning through documents: Conflicting outcomes', *Proceedings of the 38th Hawaii International Conference on System Sciences*. 3-6 January. pp. 233b-233b.
- Nielsen, L. and Madsen, S. (2006) 'Storytelling as method for sharing knowledge across IT projects', *Proceedings of the 39th Hawaii International Conference on System Sciences*, Tract 8. Hawaii 4-7 January. pp. 191a.
- Nkado, R.N. and Mbachu, J. (2001) 'Modeling client needs and satisfaction in the built environment', *Proceedings of the ARCOM Conference*, Salford 5-7 September.
- Secchi, P., Ciaschi, R. and Spense, D. (1999) 'A concept for an ESA lessons learned system', in P. Secchi (ed.) *Proceedings of Alerts and Lessons Learned: An Effective Way to Prevent Failures and Problems*. (Technical Report WPP-167). ESTEC: Noordwijk, The Netherlands, pp. 57-61.
- Selvin, A., Shum, S.B., Sierhuis, M., Conklin, J.E., Zimmermann, B., Palus, C., Drath, W., Horth, D., Domingue, J., Motta, E. and Li, G. (2001) 'Compendium: Making meetings into knowledge events', in *Proceedings of Knowledge Technologies Conference*. Austin, TX 4-7 March.
- Thuesen, C. (2005) 'Knowledge Utilization in Projects: Practice-based Perspectives', *Proceedings of the Sixth European Conference on Organizational Knowledge, Learning and Capabilities (OKLC)*, Bentley College 17-19 March. Boston, MA.
- Weber, R., Aha, D.W., Branting, L.K., Lucas, J.R. and Becerra-Fernandez, I. (2000b) 'Active case-based reasoning for lessons delivery systems', *Proceedings of the Thirteenth Annual*

Conference of the International Florida Artificial Intelligence Research Society. Menlo Park, FL: AAAI Press, pp. 170-174.

Weber, R., Aha, D.W., Muñoz-Avila, H. and Breslow, L.A. (2000c) 'An intelligent lessons learned process', in Z.W. Ras and S. Ohsuga (eds.) *Foundations of Intelligent Systems: Proceedings of the Twelfth International Symposium (ISMIS 2000)*. LNAI 1932. Berlin: Springer, pp. 358-367.

Unpublished Work

Callahan, S. (2006) 'Managing tacit knowledge with communities of practice', *White Paper published by Anecdote*, Available at: <http://www.anecdote.com.au>

Cannon, M.D. and Edmondson, A. (2006) 'Failing to learn and learning to fail (intelligently): How great organizations put failure to work to improve and innovate', *HBS Working Paper Number 04-053*. Harvard Business School, pp. 1-35.

Engleman, R. and Van de Ven, A. (2002) 'Motivating and enabling conditions of effective organizational change', *Working Paper Series*. Carlson School of Management, University of Minnesota.

Grabher, G. and Maintz, J. (2006) 'Learning in personal networks: Collaborative knowledge production in virtual forums', *Working Papers Series*. Center on Organizational Innovation, Columbia University.

Lee, D. and Steen, E.V (2007) 'Managing know-how', *HBS Working Paper*, Number 07-039, pp. 1-21.

Paalumäki, A. (2000) *Time and Organizational Identity: Discourses of the Past and the Future as Constructors of the Organizational Self*. The Management Centre. King's College London,

Pyatt, E.J. (2006) 'Case writing tips: What is a case', *Online material for Teaching and Learning with Technology*. Pennsylvania State University. [Online]. Available at: <http://tlt.its.psu.edu/suggestions/cases/casewhat.html> (Accessed: 14 July 2005).

Tanburn, J. (2000) 'Facilitating enterprise visits as a business opportunity', *The FIT Manual Series*. Geneva: International Labour Organization.

Recommended Further Reading

Argyris, C and Schön, D A (1996) *Organizational Learning II: Theory, Method, and Practice*. Reading, MA: Addison-Wesley Publishing Company.

Argyris, C. (1990) *Overcoming Organizational Defenses: Facilitating Organizational Learning*. Boston: Allyn and Bacon.

Argyris, C. (1992) *On Organizational Learning*. Oxford: Blackwell Business.

Starkey, K. Tempest, S. McKinlay, A. (2004) *How Organizations Learn: Managing the Search for Knowledge*. 2nd edn. London: Thomson.

Publications Resulting from the Research

Investigating Learning in Construction Organisations

Mahdiputra, S., Giddings, B., Hogg, K. and Daws, M.

Proceedings of the Twenty First ARCOM Conference, Vol.2, pp.1299-1311.
SOAS, London: 7-9 September 2005.

This paper presents some preliminary findings that resulted from the research. Two classifications of construction companies were identified, namely those that are engaged in general contracting business and those engaged in a specialty contracting business. The former tends to reform their project teams for each new project, whilst the latter favours maintaining their teams together for different projects. The initial premise proposed in the paper is that each of these practices may imply different learning mechanisms and adopt different learning traditions. Further investigation and analysis in the subsequent stage of the research has been developed based on these initial findings.

Organisational Learning in Construction Companies

Mahdiputra, S., Giddings, B., Hogg, K. and Daws, M.

Proceedings of the Fifth International Postgraduate Research Conference in the Built and Human Environment, Vol.2, pp.696-711.
University of Salford, Manchester: 14-15 April 2005.

[THIS PAPER WON THE RICS AWARD FOR BEST PAPER AT THE POSTGRADUATE RESEARCH CONFERENCE]

The paper reports on the first stage of data collection in the form of a business environment audit. This involved an evaluation of the type and size of projects undertaken by the sample companies and how the project teams were managed. In itself, the results contain new empirical data that expose an informative snapshot of the North East construction activities, from which the study derives its context. Later sections of the paper outline how the rest of the study was to develop.

Organisational Learning in Construction,

Mahdiputra, S., Giddings, B., Hogg, K. and Daws, M.

Research Summary Paper presented at the PhD Workshop of the Sixth European Conference on Organisational Knowledge, Learning and Capabilities.
Bentley College, Boston, MA: 17-19 March 2005,

This paper summarises the theoretical perspective on the current state of knowledge about organisational learning in construction. It also details the full methodology to be adopted in the research. In overall terms, the paper discusses six major stages in the research process: review of the current state of knowledge, business environment audit, data collection, data analysis, model development, and model evaluation.